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SCOPING STUDY

# Colchester Avenue: Bikeways, Parking, and Intersection Safety Study

Burlington, VT

PREPARED FOR



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## Executive Summary

The Colchester Avenue: Bikeways, Parking, and Intersection Safety Study was conducted in coordination with the Chittenden County Regional Planning Commission, City of Burlington, and an Advisory Committee consisting of community stakeholders. Public meetings and targeted outreach were also conducted to gather input from residents, property owners, and business owners along the corridor.

The goal of this study was to identify transformational, long-term improvements along the Colchester Avenue corridor and at the intersection of Colchester Avenue and East Avenue that re-envision the multimodal gateway corridor following years of incremental change outlined in previous planning and design efforts. The study focused on consistent, multimodal improvements for the one-mile long corridor from the connection with Pearl Street at the intersection of North and South Prospect Streets, east to the Greenmount Cemetery, then north to Barrett Street and the Winooski River crossing. In addition, the study pursued safety improvements for the intersection of Colchester Avenue and East Avenue.

### Purpose and Need

The purpose of the Colchester Avenue: Bikeways, Parking, & Intersection Safety Study was to identify and prioritize improvements along the corridor which will enhance bicycle mobility and improve parking management while supporting local businesses and at the intersection of East Avenue which will improve safety for all modes of transportation. The needs identified for this project are to improve intersection safety, improve corridor safety for all users, enhance mobility for bicyclists, and manage parking while supporting local businesses, employers, and residents.

### Existing Conditions

This corridor is used by up to 15,000 vehicles per day and serves as a major corridor for transit, including service for Green Mountain Transit (GMT) and UVM Campus Area Transit Service (CATS). Existing land uses along the corridor are varied and include institutional, neighborhood activity center, neighborhood mixed use, recreation and conservation areas, and low and medium-density residential. The corridor has been identified by VTrans as a priority for safety improvements with three High Crash Location (HCL) intersections and one HCL segment, representing 55 injury and 2 fatal crashes over a five-year period. A Highway Safety Improvement Program (HSIP) Location Review conducted at the Colchester Avenue and East Avenue intersection included recommendations to realign East Avenue and update signal equipment to improve safety.

### Stakeholder and Public Outreach

Public outreach through a Local Concerns Meeting early in the study revealed some common themes, including desire for consistent and protected pedestrian and bicycle accommodations, improved accommodations at intersections for pedestrians and bicyclists, curbside access to transit, and neighborhood based solutions to on-street parking while supporting the high turnover parking needs of businesses.

### **Corridor Concepts and Intersection Alternatives**

The following three focus areas were examined along the corridor: 1) the Colchester Avenue corridor west of East Avenue, 2) the Colchester Avenue corridor east of East Avenue, and 3) the intersection of Colchester Avenue and East Avenue. Based on existing conditions assessments, previous studies, and input gathered from stakeholders and the public, concepts were developed for the corridor segments. Alternatives that also considered the safety analyses were developed for the intersection. An analysis conducted for each of three focus areas evaluated to arrive at preferred corridor concepts and intersection alternative plan for Colchester Avenue from South Prospect Street to Barrett Street. Metrics of evaluation fell into the categories of cost, safety outcomes, project impacts, and community character. Relative comparisons of these metrics across the options helped guide stakeholders to arrive at a package of preferred improvements for the corridor.

### **Preferred Corridor Concept and Intersection**

Based on findings from technical analyses and input from the public and the project Advisory Committee, conceptual plans were developed to reflect the preferred corridor concepts and intersection alternative. This consisted of a combination of raised and separated bike lanes along the corridor segments with targeted on-street short-term parking and pull-outs for transit stops, delivery vehicles, or other short-term uses as well as new equipment, striping, a crossing on the western leg of the intersection, and a dedicated bike signal for the intersection with East Avenue.



# 1

## Introduction

The Colchester Avenue: Bikeways, Parking, and Intersection Safety Study examines the length of the Colchester Avenue corridor and the intersection with East Avenue to identify a suite of transportation recommendations that improve intersection safety, enhance mobility for bicyclists, improve safety for all users, and manage parking along the corridor. The corridor has seen incremental implementation of shorter-term improvements based on the recommendations from the 2011 Corridor Study. Building on that study and the more recent scoping for the Riverside Avenue / Barrett Street / Mill Street intersection, this study focused on re-envisioning the Colchester Avenue to make long-term, multimodal improvements to this vital gateway corridor. Significant input from the Advisory Committee, public, and business owners helped to guide the study, [input final notes after meetings with Burlington TEUC and City Council]

## 1.1 Project Overview

The Colchester Avenue: Bikeways, Parking, and Intersection Safety Study was conducted in coordination with the Chittenden County Regional Planning Commission (CCRPC), City of Burlington, and an Advisory Committee consisting of representatives from the Vermont Agency of Transportation (VTrans), Green Mountain Transit (GMT), University of Vermont (UVM), University of Vermont Medical Center (UVMC), Burlington Walk Bike Council (BWBC), Burlington Wards 1 & 8 Neighborhood Planning Assembly (NPA), Burlington Community Economic Development Office (CEDO), and Burlington City Council. Public meetings and targeted outreach were also conducted to gather input from residents, property owners, and business owners along the corridor.

The goal of this study was to identify transformational, long-term improvements along the Colchester Avenue corridor and at the intersection of Colchester Avenue and East Avenue that re-envision the multimodal gateway corridor following years of incremental change outlined in previous planning and design efforts.

Along the one mile stretch of Colchester Avenue, the study focused on consistent, multimodal improvements for the corridor from the connection with Pearl Street at the intersection of North and South Prospect Streets, east to the Greenmount Cemetery, then north to Barrett Street and the Winooski River crossing. In addition, the study pursued safety improvements for the intersection of Colchester Avenue and East Avenue.

## 1.2 Purpose and Need

The purpose and need for the Colchester Avenue: Bikeways, Parking, & Intersection Safety Study were developed with the Advisory Committee with input from the public. The resulting project purpose and needs are outlined below.

### 1.2.1 Purpose of the Project

The purpose of the Colchester Avenue: Bikeways, Parking, & Intersection Safety Study is to identify and prioritize improvements:

- › along Colchester Avenue from South Prospect Street to Barrett Street which will enhance bicycle mobility and improve parking management while supporting local businesses;
- › at the intersection of Colchester Avenue and East Avenue which will improve safety for all modes of transportation.

### 1.2.2 Needs for the Project

The needs for this project are:

- › **Improve Intersection Safety:** There are four designated High Crash Locations (HCL) along the Colchester Avenue corridor, including three intersections and one section. The HCL intersections of Colchester Avenue / Prospect Street / Pearl Street and Colchester Avenue / Barrett Street / Riverside Avenue have been studied separately with recommendations to improve the safety at those intersections. However, the Colchester Avenue / East Avenue intersection, where 44 crashes occurred between 2012 and 2016, remains an HCL requiring further investigation and improvement. A Highway Safety Improvement Program Location Review identified the visibility and alignment of signal heads as problematic and recommended relocating signals with new mast arms and signal heads.
- › **Improve Corridor Safety for all Users:** The section of Colchester Avenue between Mansfield Avenue and East Avenue is the most heavily utilized segment of the corridor and an HCL with 88 crashes over the period from 2012 to 2016. Access to the region's only Level I Trauma Center and one of the largest employers in the state is facilitated by the segment, as well as the movement of people by foot, bike, transit, and vehicle. This makes the corridor a critical link in the region's infrastructure as well as a complex, multimodal corridor in terms of operation. Of the 347 crashes identified for the length of Colchester Avenue from 2014 through 2018, 14 crashes involved bikes and 9 crashes involved pedestrians.
- › **Enhance Mobility for Bicyclists:** The BTV Walk Bike Master Plan calls for a "more robust treatment in the long-term" to provide protected bicycling infrastructure on Colchester Avenue and the 2017 CCRPC Active Transportation Plan identified Colchester Avenue as a high priority, high feasibility corridor for improvement in the active transportation network. The existing bicycle facilities are inconsistent, changing multiple times along the one-mile corridor, and not well connected, both from segment to segment along the corridor and to other adjacent or intersecting facilities.
- › **Manage Parking while Supporting Local Businesses, Employers, and Residents:** The limited right-of-way available to facilitate this heavily utilized multimodal corridor with vehicles, bicyclists, pedestrians, and transit-users has limited the on-street parking supply along the roadway. However, coordination between the City and the adjacent institutions and landowners presents an opportunity for shared parking that may address business, employer, and residential parking needs.



# 2

## Existing Conditions

The first step of the Colchester Avenue: Bikeways, Parking, and Intersection Safety Study was to identify the existing transportation, natural resource, and land use conditions along the project corridor to identify issues and opportunities to be addressed through the study. This chapter includes an evaluation of the corridor's existing conditions, including land use characteristics, existing transportation infrastructure, historic safety data, and a review of previous studies.



## 2.1 Study Corridor Description

The mile-long study corridor is located along Colchester Avenue with a western terminus at South Prospect Street and an eastern terminus at Barrett Street, immediately south of the Colchester Avenue and Riverside Avenue intersection. Colchester Avenue serves as the main connection between Burlington and Winooski and provides direct access to downtown Burlington to the west and to downtown Winooski to the northeast. This corridor is used by up to 15,000 vehicles per day. Colchester Avenue is also a major corridor for Green Mountain Transit (GMT) routes: the Blue Line (Essex to Shelburne), the Purple Line (Burlington to Burlington International Airport), and six commuter routes utilize the corridor. The UVM campus buses also use Colchester Avenue from Trinity Campus to South Prospect Street.

The full project study corridor is shown in **Figure 1** on the following page.

## 2.2 Land Use & Zoning Characteristics

Existing land uses along the corridor are varied and include institutional, neighborhood activity center, neighborhood mixed use - Riverside, RCO-Conservation, RCO-Recreation/Greenspace, and low and medium-density residential. The immediate surrounding land use for Colchester Avenue is primarily institutional to the west and changes to low-density residential as it moves east, away from UVM.

The zoning districts along the corridor and adjacent area are shown in **Figure 2**.

Figure 1: Project Area

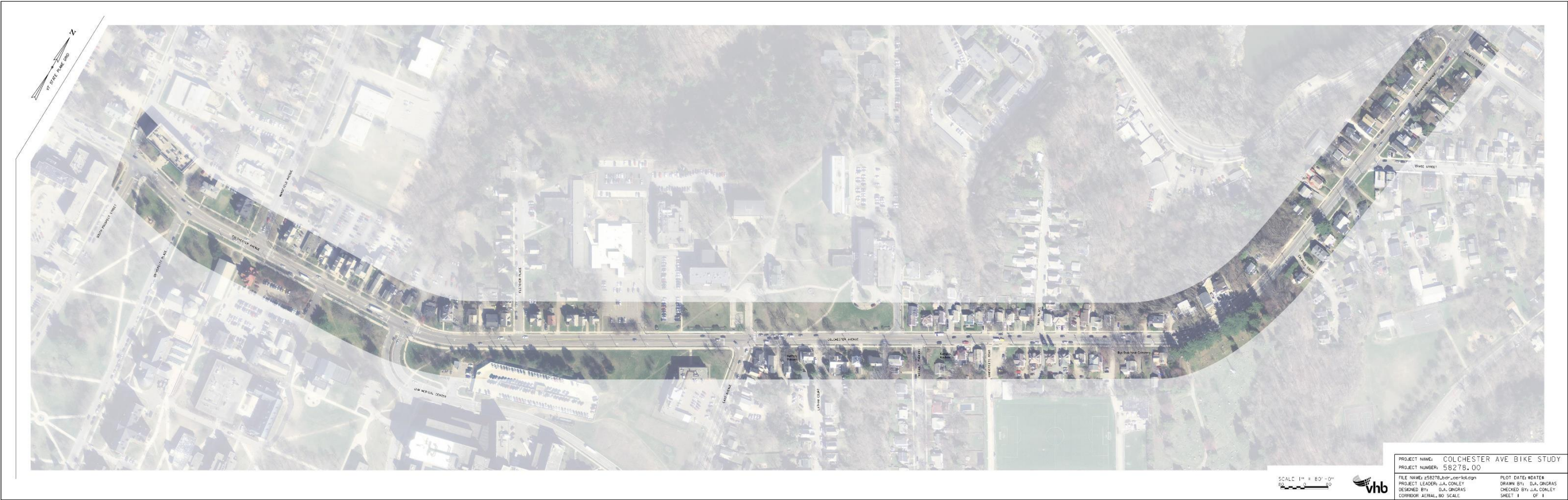




Figure 2: Project Area Zoning Map



## 2.3 Transportation System Characteristics

The following section summarizes the relevant transportation system characteristics of Colchester Avenue throughout the project area. Existing conditions identified as part of this study include daily traffic volumes, roadway geometry, multi-modal facilities, and other roadway elements.

Functional Classification: Minor Arterial

Right of Way (ROW): 5 rods (~80 feet)

2018 Annual Average 15,000 vehicles per day (west end of corridor)

Daily Traffic (AADT): 10,000 vehicles per day (east end of corridor)

Adjacent Land Uses: **South Prospect to East Avenue**

Primarily institutional with one section of medium density residential land use along Fletcher Place. The institutional land use areas include the University of Vermont, University of Vermont Medical Center, Burlington School District Offices, and several small medical practice offices (chiropractor, physical therapy, OB-GYN, dentist, etc.).

**East Avenue to Greenmount Cemetery**

Institutional and low density residential. The institutional land use areas include the University of Vermont's Trinity Campus and Centennial Field. The low-density residential areas are along Colchester Avenue as well as a number of no outlet side streets including Latham Court, Thibault Parkway, and Nash Place.

**Greenmount Cemetery to Barrett Street**

Recreation/greenspace and low density residential. The recreation/greenspace designation includes Greenmount Cemetery and Centennial Woods Natural Area. The low-density residential in the Old East End neighborhood flanks Colchester Avenue on both sides as well as along a few side streets including Calarco Court, Colchester Court, Chase Street, and Barrett Street.

Pedestrian Facilities:

- 5' sidewalks flank the full length of Colchester Avenue on both sides
- 10' Shared Use Path is available on the south side of Colchester Avenue between South Prospect Street and East Avenue
- Crosswalks are located at:
  - Barrett Street

- Chase Street (Rectangular Rapid Flashing Beacon (RRFB) to be installed)
- University Road at Centennial Field – RRFB
- East Avenue (east leg only)
- Fletcher Place – RRFB
- UVM Medical Center Entrance (east leg only)
- Mansfield Avenue
- South Prospect Street

Bicycle Facilities:

- Bike accommodations include:
  - South Prospect Street to Fletcher Place | bike lanes in both directions
  - Fletcher Place to East Avenue | westbound bike lane, eastbound sharrows with right turn lane
  - East Avenue to Calarco Court | westbound bike lane, eastbound sharrows with travel lane
  - Calarco Court to Barrett Street | buffered bike lanes in both directions
  - 10' Shared Use Path available on the south side of Colchester Avenue between South Prospect Street and East Avenue

Corridor Intersections:

Colchester Avenue intersects with:

North & South Prospect Street | scoping completed and preferred alternative identified

University Place | included in current planning study for University Place

Mansfield Avenue | signalized three-way intersection

UVM Medical Center Entrance | signalized intersection

Fletcher Place | minor approach stop controlled

East Avenue | signalized intersection and focus of this scoping effort

Latham Court | minor approach stop controlled

Thibault Parkway | minor approach stop controlled

Nash Place | minor approach stop controlled

Calarco Court | private road

Colchester Court | private road



Chase Street | minor approach stop controlled

Barrett Street / Riverside Avenue | scoping completed and preferred alternative identified

Study Intersection

Geometry and

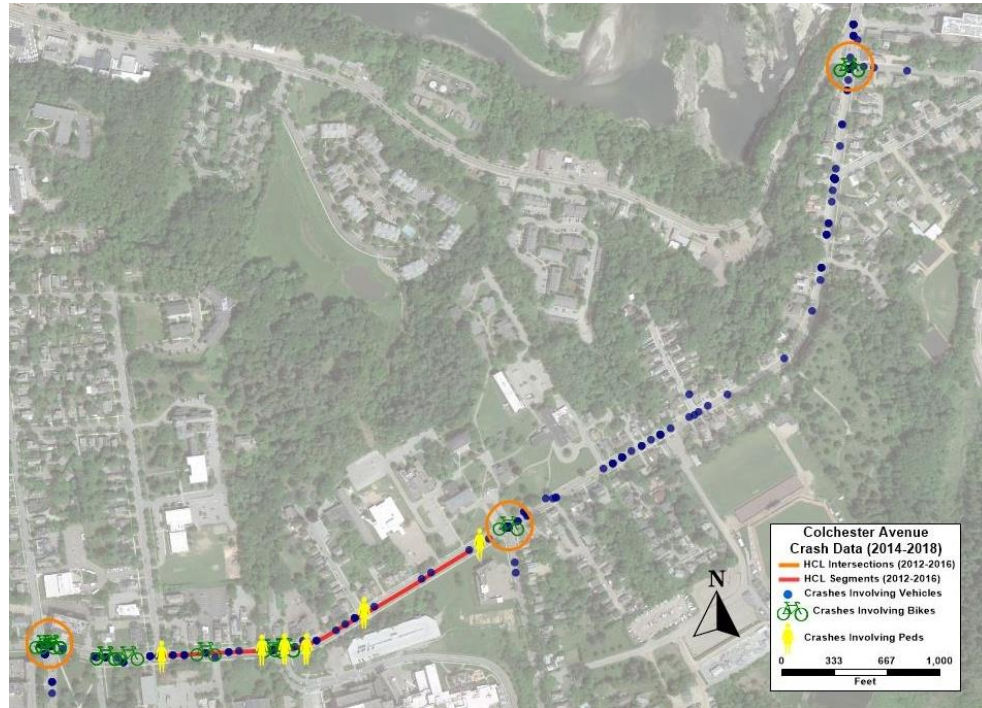
Operation:

**Colchester Avenue and East Avenue**

The East Avenue leg of the intersection meets the signalized intersection at about a 70° skew and the Trinity Campus driveway leg is offset to the east. The lane geometry consists of one through/left lane and one right turn lane on the eastbound Colchester Avenue approach, one through/right lane and one left turn lane on the westbound Colchester Avenue approach, one through/left lane and one right turn lane on the East Avenue approach, and one lane on the UVM Trinity Campus driveway approach. There are signalized pedestrian crossings on the north, south, and east legs. There are bicycle accommodations in the form of sharrows in the eastbound direction through the intersection and a bike lane in the westbound direction through the intersection. The current operation at the intersection is a split phase signal timing to serve each of the minor legs individually due in part to the offset between the two approaches.

## 2.4 Safety Assessment

A review of reported crashes along the study corridor was conducted for the most recent five-year time period that data was available (2014 – 2018). During this time period, there were 347 reported crashes, with 47 of these crashes resulting in injury. Of the reported crashes, 14 of the crashes were with bicycles and 9 of the crashes were with pedestrians. The distribution of reported crashes along the corridor is shown in **Figure 3** below. Complete crash data can be found in the Appendices.

**Figure 3: Reported Crash Locations (2014-2018) and High Crash Locations (2012-2016)**

The most recent VTrans High Crash Location (HCL) report (2012-2016) identified the following three HCL intersections along the corridor: 1) Colchester Avenue at North and South Prospect Street, 2) Colchester Avenue at East Ave, and 3) Colchester Avenue at Riverside Ave and Barrett Street. Each HCL intersection is circled in **Figure 3**. One segment of Colchester Ave from Mansfield Avenue to East Avenue, was also identified as an HCL and is also highlighted in **Figure 3**. Over the five-year period from 2012 to 2016, there were a total of 209 reported crashes within these HCLs, 55 of which resulted in an injury. Two crashes resulting in fatalities were reported during this period. A breakdown of crash data within the three HCL intersections and HCL segment is shown below in **Table 1**. High Crash Locations in Vermont are identified as those having a actual/critical ratio of greater than 1.0, where the actual rate of crashes at an intersection or on a roadway segment exceeds a threshold (i.e. critical) crash rate based on the average statewide crash rate for a given roadway functional class normalized by the exposure, or volume of traffic. The actual/critical ratio are used to rank High Crash Locations to help identify priorities for monitoring and mitigation.

**Table 1: VTrans 2012-2016 High Crash Locations**

Location	Statewide Rank	Crashes	Fatalities	Injuries	PDO* Crashes	Actual / Critical Ratio
<b>Colchester Ave and Barrett St</b>	5	34	1	7	27	2.460
<b>Colchester Ave and East Ave</b>	15	44	0	9	35	1.863
<b>Colchester Ave and N./S. Prospect St</b>	25	43	0	12	34	1.640
<b>Colchester Ave Segment</b>	119	88	1	27	67	2.088

\* PDO: Property Damage Only

In addition to the review of the crash data and High Crash Location Report, the Highway Safety Improvement Program (HSIP) Location Review conducted at the Colchester Avenue and East Avenue intersection was reviewed. The evaluation by VTrans looked at the crash data from the same High Crash Location reporting period (2012 to 2016), identifying that rear end crashes were the predominant crash type. Issues such as signal heads misaligned with lanes, pedestal mounted signals, lack of signal head backplates, and inadequate turn lanes were identified. The report included recommendations to realign East Avenue and provide sufficient turn lane geometry, replace pedestal mounted signal heads with mast arm mounted signal heads, add backplates to signal heads, replace mast arms with sufficient length to align signal heads with lanes, and eliminate flash mode from time of day plan.

## 2.5 Natural and Cultural Resources

Natural and cultural resources surrounding the corridor were evaluated to identify areas of particular sensitivity and potential permitting requirements. A desktop review of various resources, including the Vermont Agency of Natural Resources Atlas, was conducted to assemble a natural and cultural resources map identifying resources proximate to the anticipated project limits. There are no specified natural resources within the project's extent, however adjacent to the project corridor there is a historic roadside marker for the burial place of General Ethan Allen, the former Fletcher Allen hospital (now UVMMC), the Robert Hull Fleming Museum, the former Trinity College and Ira Allen School (now UVM), and access to the historic Centennial Field.

In addition, an Archaeological Resources Assessment was conducted to identify archaeologically sensitive areas that may be influenced by the project and identify the need for further investigation as the project proceeds, aligning with the Section 106 permitting process. Based on the assessment, it was recommended that if the project could be carried out entirely within the present roadway right-of-way, no further archaeological review would be necessary. However, if the project involves subsurface disturbances in areas outside of the present right-of-way, then additional review, including more focused desk review and/or hand soil cores, should be undertaken at those specific locations.

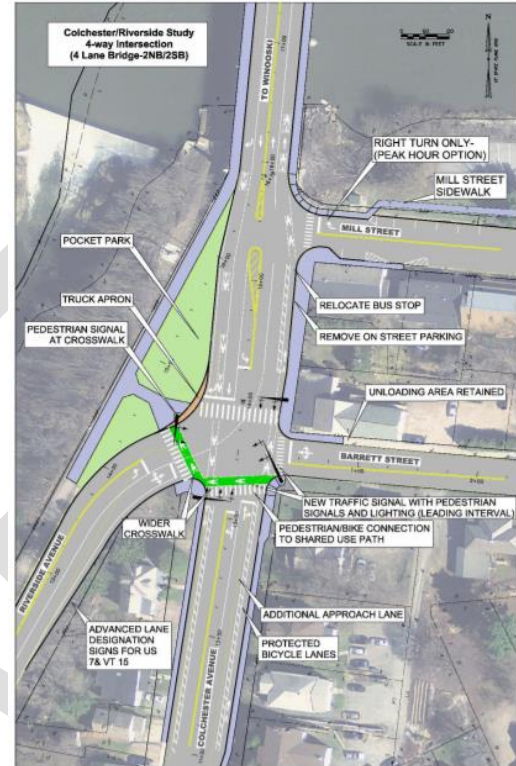
The natural and archaeological resources findings are detailed further in the Appendices.



## 2.6 Review of Previous Studies

### 2.6.1 2019 Colchester Riverside Intersection Scoping Study

The Colchester Riverside Intersection Scoping Study identified both short-term improvements and a medium-term preferred alternative to address the needs of the intersection, including improving safety and mobility for users, simplifying the intersection, enhancing the gateway into the City, and managing traffic congestion. The preferred intersection treatment is to square up the Riverside Avenue leg of the intersection with Barrett Street to create a four-way, signalized intersection with a pocket park in place of the existing skewed alignment of the Riverside leg. Connections to this preferred alternative intersection were considered for the alternatives evaluated in this study.



### 2.6.2 2014 Pearl-Prospect-Colchester Intersection Scoping Study

The Pearl-Prospect-Colchester Intersection Scoping Study identified a preferred alternative for the intersection at the western end of the study area to address the needs to improve safety at this high crash location, enhance mobility for all users, and reduce traffic congestion. Connections to this preferred intersection alternative were considered for the segment of Colchester Avenue as it approaches this intersection.



### 2.6.3 2011 City of Burlington Transportation Plan (and Burlington Street Design Guidelines)

The City of Burlington Transportation Plan identified the need for scoping on the Colchester Avenue corridor and recognized that the Colchester Avenue Task Force recommended Colchester Avenue be reconstructed as a complete street that is a “fully integrated road designed as part of a multi-modal system accommodating transit, cycling, and walking.” The Plan and its appendices outlined preliminary analyses for the conversion from a four-lane to three-lane cross-section conversion.

### 2.6.4 2011 Colchester Avenue Corridor Plan

The Colchester Avenue Corridor Plan identified a number of short-term and long-term recommendations for the corridor. These recommendations included a reconfiguration of the western section from a four lane to three lane cross-section between South Prospect Street and East Avenue. The three-lane configuration was initially implemented as a pilot project and was made permanent based on observations and analyses from the pilot. For the eastern section of the corridor, between East Avenue and Barrett Street, it was recommended that designation of bike lanes be prioritized to provide continuity along the corridor, but the challenges requiring tradeoffs between bike infrastructure, greenbelt and streetscape opportunities, and parking were recognized. Also recommended in the plan was a realignment of the East Avenue and the Trinity Campus entrance at the intersection of Colchester Avenue and East Avenue.

### 2.6.5 2017 PlanBTV Walk Bike Plan

The Colchester Avenue and East Avenue intersection was identified in the PlanBTV Walk Bike Plan as one of the top 20 intersections requiring safety improvements in the City. In the short-term, it was recommended that the shared lane markings be carried from the eastbound bike lane through to the intersection along the right



turn lane, which has been implemented. Another short-term recommendation was made for a median treatment to be piloted to provide some pedestrian refuge for those crossing Colchester Avenue at the intersection. In the longer term, the plan recommended a midblock crossing west of the intersection to reduce pedestrian crossings at the intersection, which was installed with an RRFB just east of Fletcher Place. The plan also identified a roundabout as a possible treatment for the intersection as a method for speed management, with the recommendation of a scoping study for the intersection.

In addition to the recommendations for the intersection, other treatments along the corridor within the study area were identified in the Plan. This includes investment in the improved Colchester Avenue Sidepath in the short-term by reconstructing and widening the existing facility, which was completed in 2020. In the 2-5 year time frame, the Plan calls for provision of more high visibility crossings at the UVM Medical Center entrance, realignment with curb extensions and high visibility crossings at Pearl/Prospect/Colchester Avenue intersection, curb extensions and high visibility crossings at Riverside/Colchester Avenue intersection, striping bike lanes on Colchester Avenue east of East Avenue; and a “more robust treatment to come in the long-term.”

### 2.6.6 2017 UVM Active Transportation Plan

The UVM Active Transportation Plan identified a number of projects that were integral to the improvement of biking and walking circulation both on and near campus. Intersection improvement priorities included bike boxes and west leg pedestrian crossing and signals at Colchester Avenue and East Avenue, midblock crossing of Colchester Avenue near Fletcher Place, west leg pedestrian crossing of Colchester Avenue at the Medical Center entrance, facilitating left turning bicycles from Colchester Avenue onto Mansfield Avenue, and removing the left turn lane to replace with pedestrian refuge and Colchester Avenue crossing at University Place. Bicycle and pedestrian facility priorities included dedicated bicycle infrastructure on Colchester Avenue and East Avenue, widened and extended Colchester Avenue sidepath, new Trinity Campus access road sidepaths, and formalized UVM Medical Center paths.

### 2.6.7 2017 CCRPC Active Transportation Plan

The CCRPC Active Transportation Plan identifies Colchester Avenue as part of a high priority, high feasibility regional network connectivity project. The prioritized project intends to connect Burlington through Essex to Richmond via Colchester Avenue, VT-15, and VT-117. It is recommended that such high priority, high feasibility regional projects be prioritized more favorably in the Bicycle-Pedestrian Program to receive funding through VTrans. As such, the Colchester Avenue Sidepath was identified as part of this effort, prioritized through the [Transportation Improvement Program \(TIP\)](#), supported for reconstruction from South Prospect Street to East Avenue, and completed in 2020. The plan further recommends exploring the extension of bicycle facilities from East Avenue to Winooski along Colchester Avenue.

## 2.7 Previous Projects: Design and Construction

The corridor has been the subject of a lot of change over the last decade, with incremental safety improvements to the corridor creating a more multimodal gateway into the City of Burlington. The following projects have been implemented along or adjacent to the corridor with the exception of the University Place Streetscape Improvements and the Mansfield Avenue Sidepath Project, which are in the planning and design phases respectively.

- › **2021 University Place Streetscape Improvements (Planning)** | *Conceptual design of improvements to University Place including reconfiguration to one-way vehicle traffic and bicycle and pedestrian infrastructure.*
- › **2020 Mansfield Avenue Sidepath Project (Design)** | *Development of a sidepath along Mansfield Avenue to connect with existing or proposed bike and pedestrian infrastructure on Colchester Avenue.*
- › **2020 Colchester Avenue Sidepath Project** | *Extension and reconstruction of sidepath on the south side of Colchester Avenue between South Prospect Street and East Avenue.*
- › **2019 Colchester Avenue Repaving, Water Relining, Bike Lanes, and Crossings** | *Coordination of water utility work with repaving and restriping. Striping following construction installed new buffered bike lanes between Barrett Street and Greenmount Cemetery and a westbound bike lane between Greenmount Cemetery and East Avenue. This configuration retained on street residential and short-term parking on the south side of Colchester Avenue between Greenmount Cemetery and East Avenue and eliminated parking on the north side. This project also included the installation of a crosswalk and RRFB across Colchester Avenue at Chase Street.*
- › **2019 Green Mountain Walkway Extension** | *Improvements to the connection between Colchester Avenue Sidepath and the Green Mountain Walkway on the UVM and UVM Medical Center Campus. Formalized a steep slope goat path to make a more direct and accessible connection between heavily utilized pedestrian pathways.*
- › **2018 Colchester Avenue / Riverside Avenue Pedestrian Improvements** | *Installation of updated crossings with improved landings and new pedestrian signal heads. Implementation of expanded sidewalk to better connect Riverside Sidepath to Colchester Avenue bike and pedestrian infrastructure.*
- › **2016-2018 Colchester Avenue Crosswalks** | *Installation of midblock crossings of Colchester Avenue with Rectangular Rapid Flashing Beacons near University Road at Centennial Fields and at Fletcher Place.*
- › **2014 Colchester Avenue Sidewalk at Greenmount Cemetery** | *Addition of missing section of sidewalk between the entrance to Greenmount Cemetery and Calarco Court.*
- › **2011 Colchester Avenue Pilot Project** | *Conversion of the four-lane cross section from Pearl Street to East Avenue to three-lanes as a Pilot Project and then a permanent installation.*



# 3

## Public Outreach

A robust public outreach process was conducted by engaging a diverse group of stakeholders on the project Advisory Committee and providing ample opportunities for public input over the course of the study's development. Two widely advertised public meetings were held for this project including an initial Local Concerns Meeting and a Draft Alternatives Presentation. Before and after bringing materials to the public, the Advisory Committee convened to weigh in on considerations, feedback, and concepts that led to compromise solutions for the corridor and intersection that fulfill the project Purpose and Needs. The Advisory Committee's recommendations were then presented to the Burlington Public Works Commission, Transportation, Energy, and Utilities Committee, and City Council.



### 3.1 Overview

The study falls in the Involve category on the spectrum of public participation<sup>1</sup> that the CCRPC and City of Burlington reference for projects, programs, and activities at varying levels of public participation. The CCRPC and City, along with the project team, worked directly with the public to “ensure that public concerns and aspirations are consistently understood and considered.”<sup>2</sup> The characteristics of the public engagement effort included two-way communication between the project team and the public facilitated by multiple interactions over a year and a half to advance of solutions to complex problems. The Equity Impact Worksheet required for this level of public participation and other documentation regarding the public involvement are included in the Appendices.

### 3.2 Project Advisory Committee

The project Advisory Committee consisted of a diverse group of stakeholders including representatives from the CCRPC, City of Burlington, VTrans, GMT, UVM, UVM Medical Center, Burlington Walk Bike Council, Burlington Wards 1 & 8 NPA, and Burlington City Council. The Advisory Committee convened on January 29, 2020 following the Local Concerns Meeting and again on March 19, 2020 to prepare for the Alternatives Presentation and Public Meeting. The project was paused due to the COVID-19 pandemic, so the Advisory Committee did not reconvene again until February 28, 2021 to advance a preferred alternative following the Alternatives Presentation.

The committee served an advisory role throughout the project and was responsible for representing various constituent, community, and institution perspectives in review of project process and study findings, vetting all materials and concepts, and providing guidance to the project team. The Advisory Committee provided input and ultimately finalized the Purpose and Need statement which was used as the basis for all alternative concepts and evaluation. The Advisory Committee also identified and recommended preferred alternatives along the corridor for consideration by the TEUC and City Council, as detailed later in this report.

The meetings agendas, presentations, and minutes can be found in the Appendices.

### 3.3 Local Concerns Meeting

A Local Concerns Meeting was held on December 4, 2019 to solicit public input at the onset of the project. The attendees were provided an overview of the project, background on existing conditions, and planning efforts and projects to date. Based on typical cross-sections and anticipated challenges, the corridor was segmented into four sections as follows: South Prospect Street to UVM Medical Center entrance (**Figure 4**), UVM Medical Center entrance to East Avenue (**Figure 5**), East Avenue to Greenmount Cemetery (**Figure 6**), and Greenmount Cemetery to Barrett Street (**Figure 7**). The participants were then asked to

1 International Association of Public Participation, *Spectrum of Participation*, [www.iap2.org](http://www.iap2.org).

2 CCRPC, 2014. *Public Participation Plan*.

help identify any opportunities or concerns along the Colchester Avenue corridor, as highlighted in those figures respectively. Some common themes that emerged from the discussion included:

- › consistent and protected pedestrian and bicycle accommodations;
- › improved accommodations at intersections for pedestrians and bicyclists, with particular focus on left turning bicyclists, crossing pedestrians, and appropriate lighting;
- › curbside access to transit; and,
- › neighborhood based solutions to on-street parking while supporting the high turnover parking needs of businesses.

As the study progressed, the highlighted elements were evaluated by the project team and served as the foundation for identifying many different concepts to explore for the corridor. The meeting agenda, presentation, and minutes can be found in the Appendices.

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Figure 4: Opportunities and Constraints Map 1

## Segment 1: South Prospect Street to UVM Medical Center

-  **Issue:** Given it's current phasing, some pedestrians do not feel safe crossing Colchester Avenue at the intersection with Mansfield Avenue.
-   **Opportunity:** Is there space to consider 10' wide Shared-Use Paths on both sides of the street?
-  **Issue:** The corridor needs infrastructure that allows for bicyclists to make left-turns along the corridor.
-   **Opportunity:** Improve bicyclist & pedestrian safety and operations at Colchester Avenue & S/N Prospect Street.
-   **Issue:** The No-Right-Turn LED Signs at UVM Medical Center has not been effective to date. This movement is putting pedestrians and bicyclists at risk.
-  **Issue:** There is some drainage infrastructure in this section that is dangerous to bicyclists.

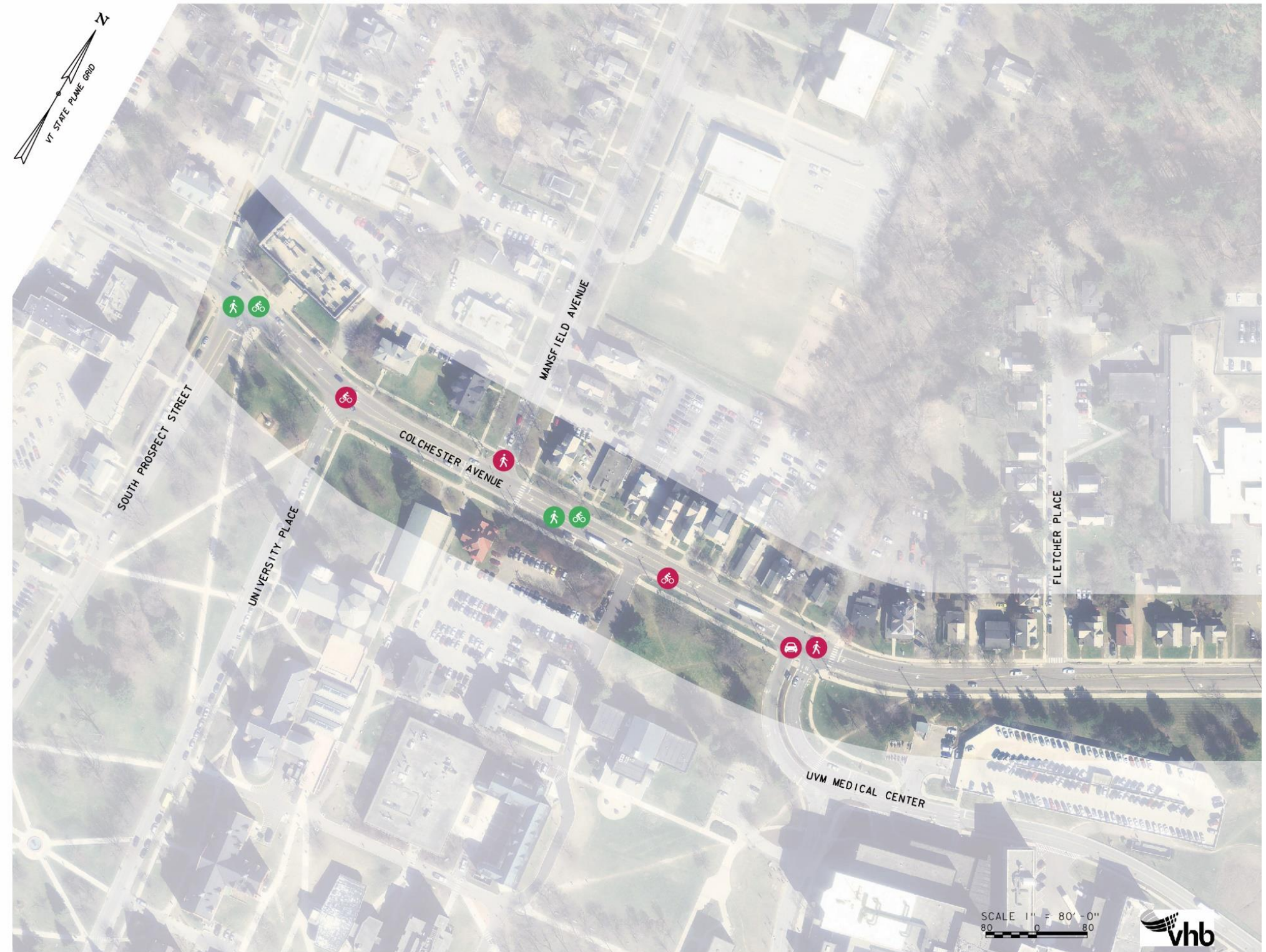




Figure 5: Opportunities and Constraints Map 2

## Segment 2: UVM Medical Center to East Avenue










- 

**Issue:** The lighting along the existing path is insufficient.
- 
**Issue:** The existing path is hazardous for bicyclists who choose to ride along it rather than in the roadway.
- 
**Issue:** The inconsistency in treatments for bicyclists makes navigating the corridor safely challenging.
- 
**Issue:** The sidewalk network lacks continuity when it transitions to East Avenue.
- 


**Opportunity:** Could the intersection with East Avenue be evaluated as a roundabout? Or could the intersection be evaluated to better accommodate bicyclist and pedestrian desire lines?
- 
**Note:** The Colchester Avenue crosswalk at Fletcher Place has been a major improvement for pedestrian safety.





Figure 6: Opportunities and Constraints Map 3

### Segment 3: East Avenue to Greenmount Cemetery

- Issue:** Westbound motorists will often pull into the bike lane at the intersection with East Avenue, endangering bicyclists.
- Opportunity:** There's an opportunity for improvements to the signal layout at East Avenue which would make conditions safer for all users.
- Issue:** Colchester Avenue to the east of East Avenue becomes extremely dangerous for bicyclists as it's a shared street condition, and motorists jockey for position at high speeds.
- Opportunity:** The perception is that congestion has improved since the removal of parking along the north side of Colchester Avenue.
- Issue:** Wide turning buses from Trinity campus make for unsafe conditions for bicyclists adjacent to "Kathy's Flowers" due to the presence of one parking space.
- Opportunity:** Is there space to consider continuing the new shared-use path along the south side of Colchester Avenue?
- Note:** The parking spaces for Kampus Kitchen are working well to date.
- Issue:** The bus stop just west of Greenmount Cemetery is challenging as the on-street parking restricts bus accessibility to the curb, making it difficult for passengers to board.





Figure 7: Opportunities and Constraints Map 4

## Segment 4: Greenmount Cemetery to Barrett Street

- P **Opportunity:** The City should undertake a Parking Management Plan for this section and consider zoned parking rather than street-only parking.
- P **Note:** The City should investigate the number of permits currently distributed against the number of spots regularly utilized.
- 🚌 🚲 **Issue:** Bicyclists are concerned about safety around bus stops, and see a need to have channelized pull-offs for bus stops that maintain separation from bicyclists.
- 🚲 **Opportunity:** Can the curbs be widened to create space for separated bike lanes?
- 🚌 **Issue:** Buses generally speed through this section of the corridor.
- 🚗 **Note:** Chase Street generally gets blocked in the PM peak hour. Enhanced markings and signing should be considered.
- 🚗 **Opportunity:** Can the intersections with East Avenue and Riverside Avenue be evaluated in coordination to understand how one intersection affects the other?





### 3.4 Draft Alternatives Presentation

An Alternatives Presentation was scheduled prior to the COVID-19 pandemic shutting down in person activities. The pandemic put the project on pause in March of 2020. When the project was reinitiated in late fall 2020, materials for the Alternatives Presentation were prepared and posted prior to the meeting via video recording to encourage familiarity with the study and alternatives prior to the virtual Public Meeting. The project team then presented the draft alternatives on January 11, 2021. The corridor was broken down into three focal areas: corridor concepts west of East Avenue, corridor concepts east of East Avenue, and intersection alternatives for the Colchester Avenue and East Avenue intersection. The alternatives presented to the public are described in detail in Chapter 4.

Based on public input, there was clear preference for a consistent cross-section along the Colchester Avenue corridor. The concepts for the corridor that were supported by the community had raised bike facilities adjacent to sidewalks and separated from the vehicular travel lanes by a greenbelt. West of East Avenue, the preference for the features of a raised, separated bike facility supported a single concept. For the segment east of East Avenue, there were three variations that included the raised, separated bike facilities that all garnered support from the public.

For the intersection of Colchester Avenue and East Avenue, preference conveyed by the public was for either a realigned intersection with new traffic signal equipment and a bike signal or a roundabout above the other options. Between these two alternatives, the realigned and signalized intersection option was favored. More detailed information regarding the features of each of these alternatives was gathered to bring to the Advisory Committee for discussion and resolution.

The Advisory Committee convened to discuss the alternatives still under consideration after the public meeting and identify any adjustments that could be made to come to a compromise that could be supported by the community. The Advisory Committee affirmed the raised, separated bike facility concept for the section west of East Avenue. For the corridor segment east of East Avenue, discussion of a compromised solution that borrows features from each of the three alternatives was supported by the majority. The changes suggested by the Advisory Committee to the draft alternatives are reflected in the preferred alternative conceptual plans in Chapter 5. The adjustments include maintaining a consistent raised, separated bike facility adjacent to the sidewalk, high turnover, short-term parking in front of Kampus Kitchen, and maintaining curbside pull-outs for the purposes of high turnover, short-term parking, transit stops, and deliveries. For the intersection, following discussion of the features of a signalized realignment option and a roundabout, the preferred alternative of the signalized intersection with realignment and a bike signal emerged.

The meeting agendas, presentations, and minutes can be found in the Appendices.

### 3.5 Preferred Alternative Presentations

[Hold for Public Works Commission, TEUC, and City Council Outcomes. The meeting agenda, presentations, and minutes can be found in the Appendices.]

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# 4

## Corridor Concept and Intersection Alternatives Analysis

An analysis conducted for each of three focus areas evaluated the validity of various options to arrive at a preferred conceptual plan for the Colchester Avenue corridor from South Prospect Street to Barrett Street. The following three focus areas were examined along the corridor: 1) the Colchester Avenue corridor west of East Avenue, 2) the Colchester Avenue corridor east of East Avenue, and 3) the intersection of Colchester Avenue and East Avenue. Metrics of evaluation fell into the categories of cost, safety outcomes, project impacts, and community character. Relative comparisons of these metrics across the options helped guide stakeholders to arrive at a package of preferred improvements for the corridor.

## 4.1 Corridor Concepts – West of East Avenue

The western end of the Colchester Avenue corridor stretches from where Colchester Avenue transitions to Pearl Street at the intersection with South Prospect Street to the East Avenue intersection, see **Figure 8**.

The concepts evaluated for the western end of the corridor included a No Build concept, on-street separated bike lanes, and raised, separated bike lanes.

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Figure 8: Corridor West of East Avenue





#### 4.1.1 No Build (West)

The No Build scenario was examined as a baseline condition for the purposes of comparison.

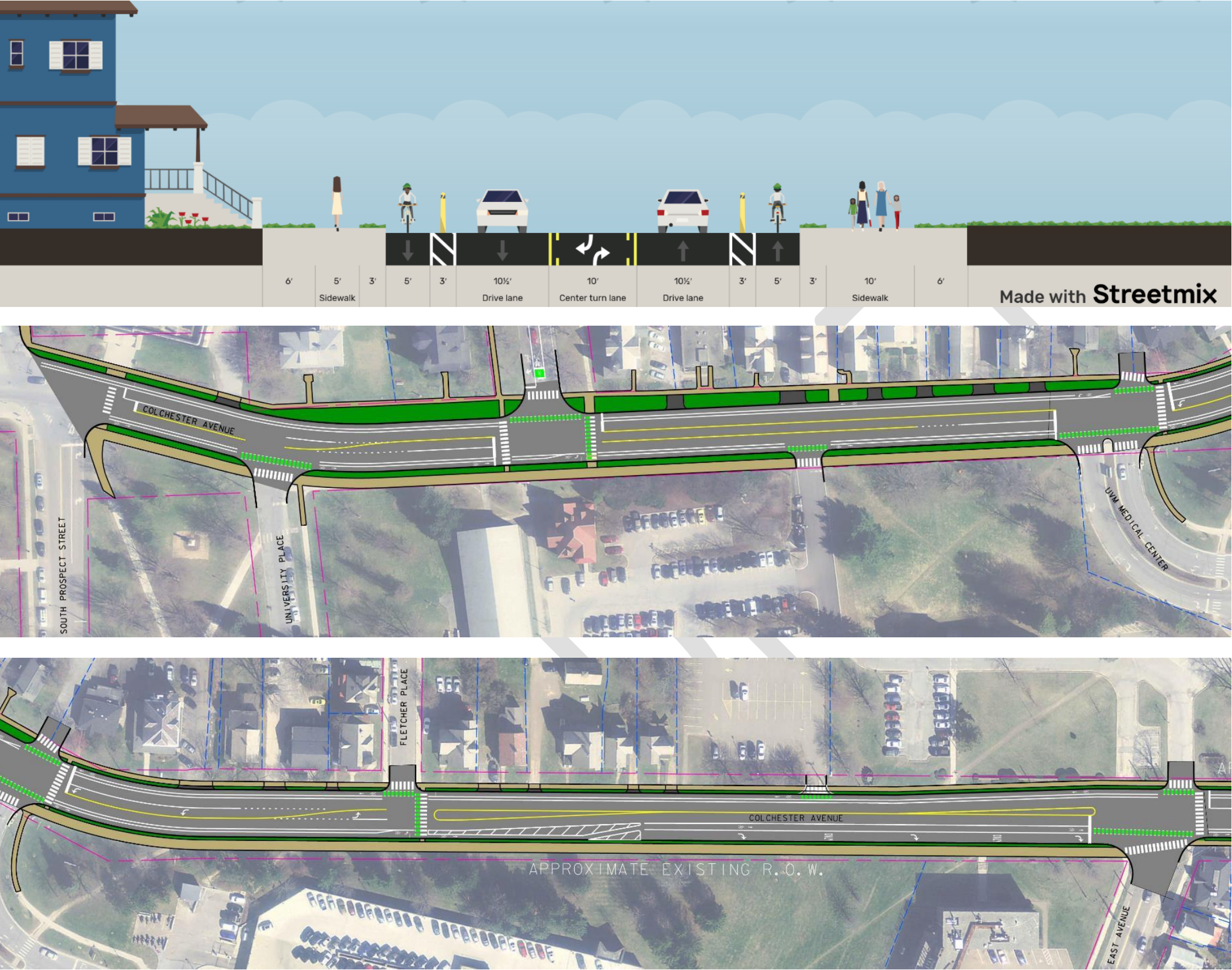
#### 4.1.2 Concept 1 (West) – On-Street Separated Bike Lanes

Concept 1 would establish new curb lines located at a 47' width to provide for protected bike lanes at street level. A vertical element, bollards or other approved devices, would be introduced in the 3' buffer to further delineate the dedicated bicycle space in the cross-section. With few driveways along stretches of this segment, particularly on the south side of the corridor, the vertical element could be placed at consistent intervals without a lot of interruption. This alternative would require striping to establish the dedicated spaces within the curb. For instance, two-stage left turns for cyclists would be established with striping on the pavement at each of the side streets.

This cross-section would allow for at least 6' of greenbelt between the bike facility and sidewalk to the north or shared use path to the south for the segment west of Medical Center. At least 3' of greenbelt between the bike facility and sidewalk to the north or shared use path to the south would be accommodated east of Medical Center. Although shifting curb would require some disruption to the current greenbelt, there would be opportunity for tree plantings, lighting, and other greenbelt features in this scenario.

A graphic of the typical corridor cross-section and the plan view of Concept 1 both west and east of the Medical Center are included in **Figure 9**.

Figure 9: Colchester Ave Corridor Concept 1 (West): On-Street Separated Bike Lanes



#### 4.1.3 Concept 2 (West) – Raised, Separated Bike Lanes

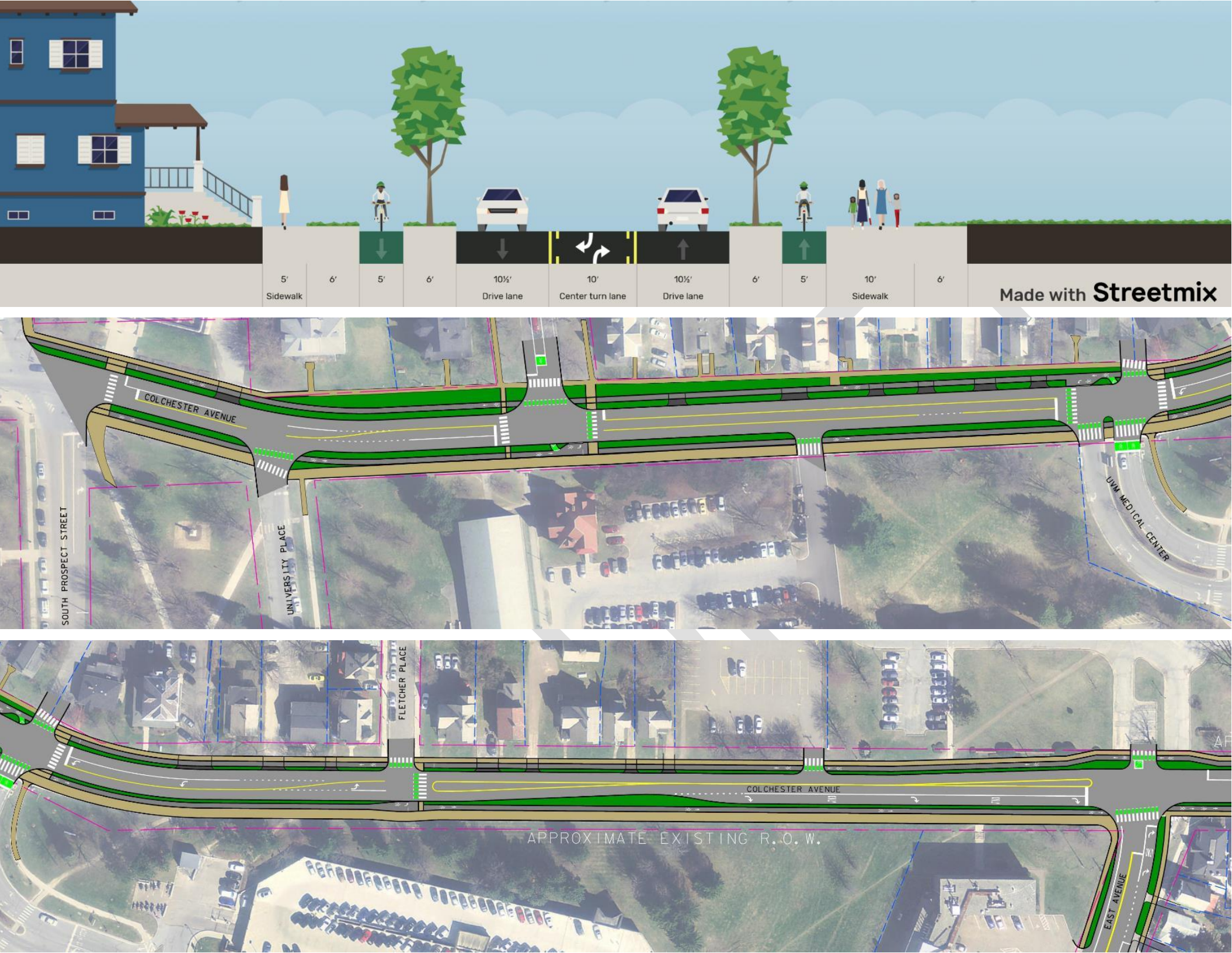
Concept 2 envisions bike lanes along the corridor that are grade and greenbelt separated from the vehicle lanes. The concept draws in the curb lines to a 31' width to provide the travel lanes and shared left turn lanes for vehicle traffic. Outside of the curb line, a greenbelt of at least 6' west of the Medical Center and at least 3' east of the Medical Center would be established with the bike lane beyond it. In most sections, the raised bike lane would be adjacent to the sidewalk or shared use path. The bike and pedestrian facilities would be delineated with a short, beveled curb and have different surface treatments to clearly designate the two facilities.

A graphic depicting the typical corridor cross-section and the plan view of Concept 2 both west and east of the Medical Center are included in **Figure 10**.

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Figure 10: Colchester Ave Corridor Concept 2 (West): Raised, Separated Bike Lanes



4.1.4 Corridor Concepts West of East Avenue – Evaluation Matrix

An evaluation matrix of the corridor concepts presented in Section 4.1 is shown in **Table 2** below. This matrix compares the relative costs, safety, impacts to various resources, and community character implications for each concept.

Table 2: Colchester Avenue Corridor Concepts West of East Avenue - Evaluation Matrix

		Colchester Avenue Corridor Concepts (West)		
		Concept 0 No Build	Concept 1 (West) On-Street Separated Bike Lanes	Concept 2 (West) Raised and Separated Bike Lanes
Costs	Total Cost	\$0	\$\$	\$\$\$
	Bicycle Safety	-	Improved <i>Cyclists in separated facility</i>	Improved <i>Cyclists in separated facility</i>
	Pedestrian Safety	-	Improved <i>Pedestrians in separated facility</i>	Improved <i>Pedestrians in separated facility</i>
	Vehicle Safety	-	Slightly Improved <i>Reduce conflicts with cyclists by defining and separating spaces</i>	Slightly Improved <i>Reduce conflicts with cyclists by defining and separating spaces</i>
Impacts	Utility Impacts	-	Major Impacts	Major Impacts
	ROW Impacts	-	No Impacts	No Impacts
	Constructability	-	Major Effort	Major Effort
	Parking	-	No Change	No Change
	Trees	-	Moderate Impacts to Existing; Some Tree Belt Opportunity	Moderate Impacts to Existing; Some Tree Belt Opportunity
	Historic	-	No Impacts	No Impacts
	Archaeological	-	No Impacts	No Impacts
Community Character	Aesthetics	No Change	No Change	Improved
	Satisfies Purpose & Need	No	Yes	Yes

\* unmet on-street parking need requiring alternative locations to accommodate parking



## 4.2 Corridor Concepts – East of East Avenue

Although the right-of-way along the Colchester Avenue corridor is 5 rods, or about 80 feet, the segment east of East Avenue is a tighter cross section than the western end due to the limited setback of structures. The curb-to-curb width is approximately 35' in the existing condition as depicted in **Figure 11**.

The concepts evaluated for the eastern end of the corridor included a No Build concept, on-street separated bike lanes, raised and separated bike lanes, raised and separated bike lanes with enhancements, raised and separated bike lanes with enhancements and a mixing zone, and a shared use path.

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Figure 11: Corridor East of East Avenue





#### 4.2.1 No Build (East)

In order to understand the impacts resulting from changes to this corridor cross-section, the existing conditions were first analyzed.

Because the updated striping in the No Build condition is relatively new for this segment of the corridor, the striping plans were included in the Appendices for reference.

#### 4.2.2 Concept 1 (East) – On-Street Separated Bike Lanes

Concept 1 for the eastern end of the corridor is consistent with Concept 1 (West). Through this section, the bike facilities are proposed to be on street level within a newly located curb line with a 3' buffer between the vehicular through lanes in either direction. Again, it is proposed that the buffer will have a vertical element, but through this section the locations available for bollards or other vertical devices will be more limited due to the significant number of driveways. The concept envisions repurposing the existing curb-to-curb entirely to vehicular traffic and separated bike lanes, eliminating the remaining on-street parking on the south side of the road between East Avenue and Greenmount Cemetery.

A graphic depicting the typical corridor cross-section and the plan view of Concept 1 in two segments are included in **Figure 12**.

Figure 12: Colchester Ave Corridor Concept 1 (East): On-Street Separated Bike Lanes



#### 4.2.3 Concept 2 (East) – Raised, Separated Bike Lanes

Concept 2 on the eastern end of the corridor is consistent with Concept 2 (West). Through this section, the bike facilities are proposed to be horizontally and vertically separated from the vehicular travel lanes with curb and a greenbelt. Through this section, it is again proposed that the raised, separated bike lanes would be adjacent to the sidewalk with a small, beveled curb between the two facilities and different surface treatments to distinguish the facilities. Through this section, the curb-to-curb width is adjusted to 26' to accommodate the 11' width travel lanes in each direction with 2' shoulders next to the curb and no on-street parking along corridor.

A graphic of the typical corridor cross-section and the plan view of Concept 2 in two segments are included in **Figure 13**.

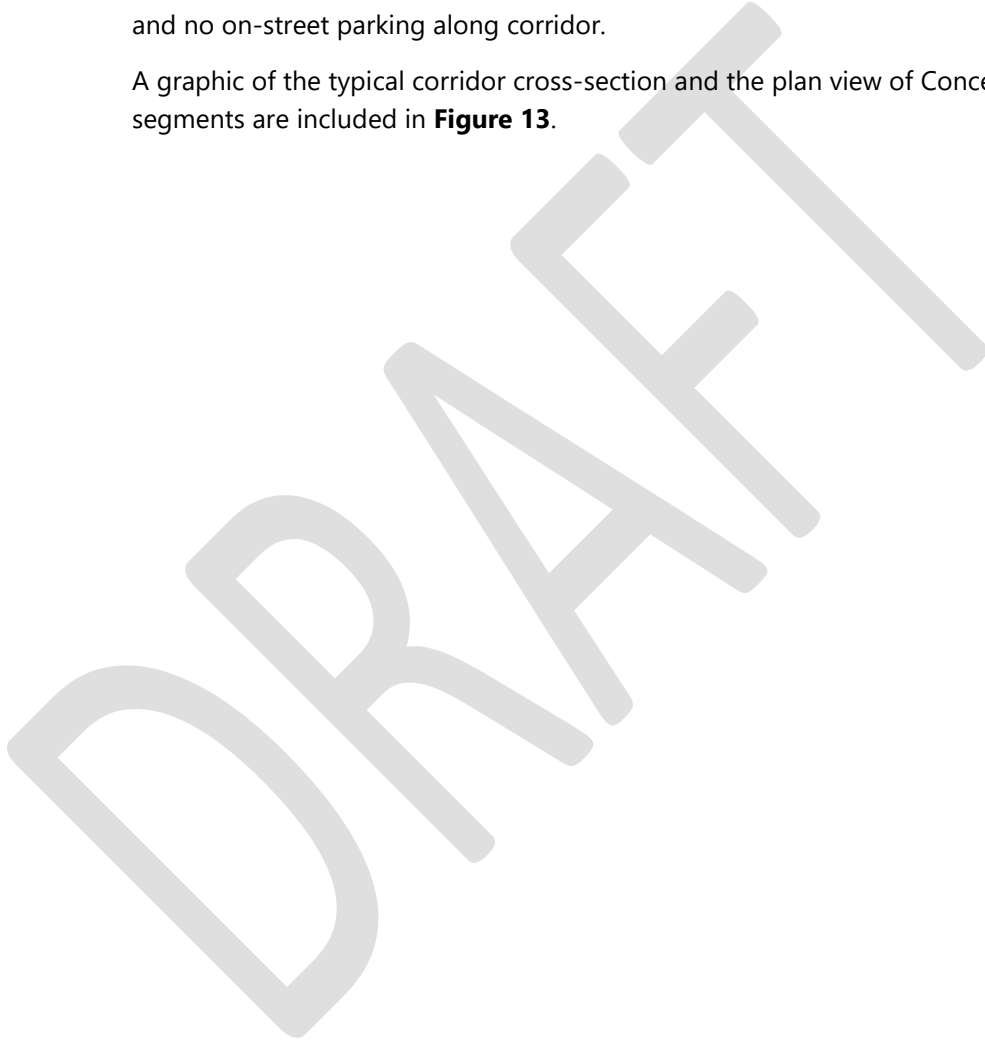




Figure 13: Colchester Ave Corridor Concept 2 (East): Raised, Separated Bike Lanes



#### 4.2.4 Concept 3 (East) – Raised, Separated Bike Lanes with Enhancements

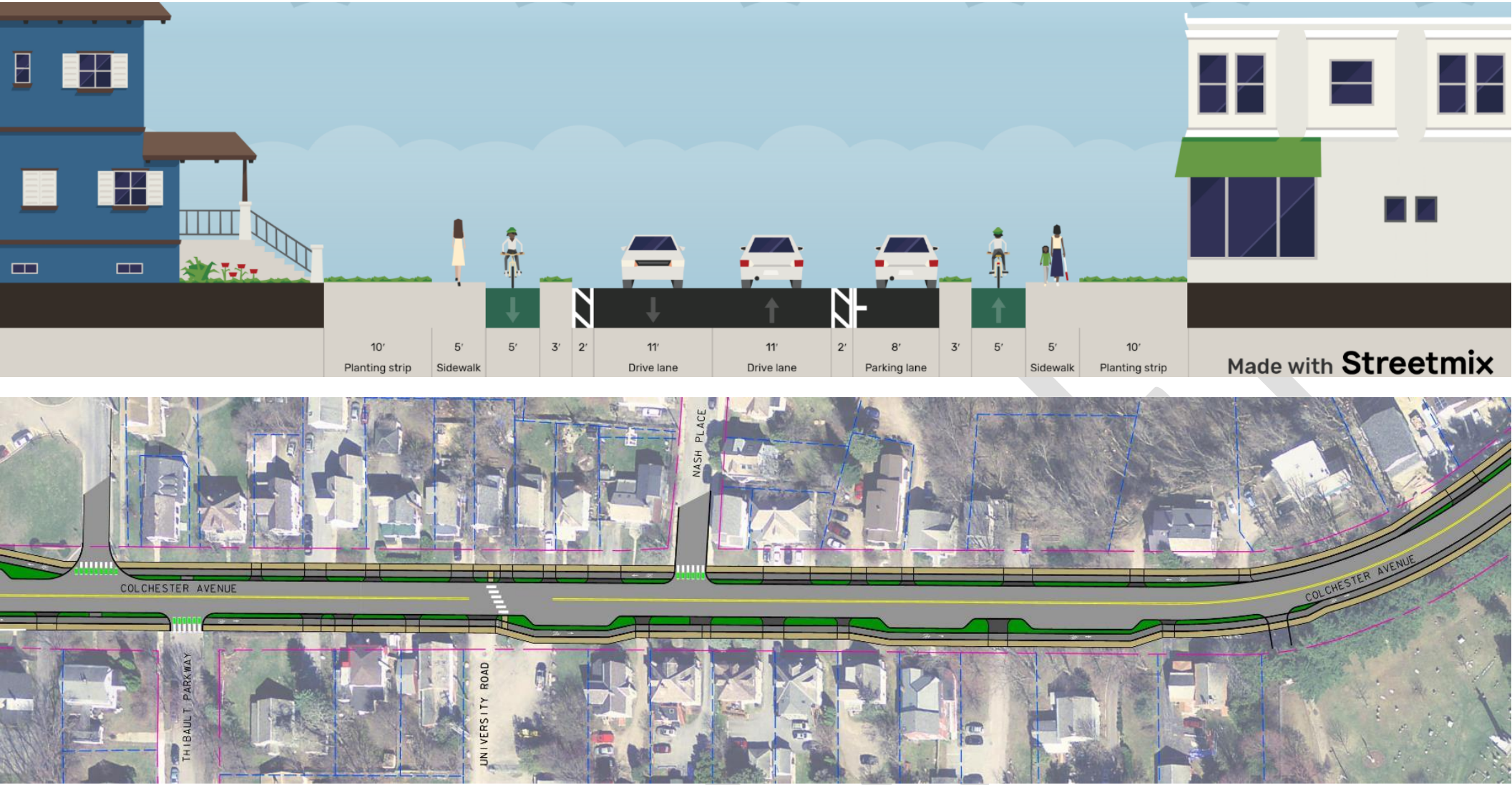
Concept 3 for the eastern end of the corridor borrows from Concept 2, but adds in strategic curbside pull-outs along the segment for the purposes of either parking or bus transit stops. Locations for the pull-outs were identified based on minimizing impacts beyond the existing back of sidewalk and maximizing the length available for the pull-out where driveways or side streets were spaced appropriately. These pull-outs were added in places where there are existing bus transit route stops or where there may be a need for on-street parking, like in proximity to Kampus Kitchen.

A graphic depicting the typical corridor cross-section and the plan view of Concept 3 are included in **Figure 14**. Note that Concept 3 remains the same as Concept 2 between the Greenmount Cemetery and Barrett Street.

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Figure 14: Colchester Ave Corridor Concept 3 (East): Raised, Separated Bike Lanes with Enhancements



#### 4.2.5 Concept 3A (East) – Raised, Separated Bike Lanes with Enhancements and Mixing Zones

A variation of Concept 3 (East), Concept 3A resulted from the outreach conducted to better understand the parking needs along the corridor. The demand for high-turnover parking, particularly in front of Kampus Kitchen, resulted in an exploration of tradeoffs through the tighter cross section along the eastern end of the corridor. In this concept, the block between Thibault Parkway and the Centennial Field entrance would have a mixing zone as opposed to separated bike lane and sidewalk, with the additional width reallocated to 2-3 high-turnover, 15-minute, on-street parking spaces. The mixing zone was envisioned to make bicyclists and other through users of the bike and pedestrian facilities more aware of the cross traffic through this section, particularly in anticipation of peak activity at Centennial Field or Kampus Kitchen.

A graphic depicting the typical corridor cross-section and the plan view of Concept 3A are included in **Figure 15**. Recall that Concept 3A remains the same as Concept 2 between Greenmount Cemetery and Barrett Street.



Figure 15: Colchester Ave Corridor Concept 3A (East): Raised, Separated Bike Lanes with Enhancements and Mixing Zone





#### 4.2.6 Concept 4 (East) – Shared Use Path

Similar in character to the shared use path that already exists along the western end of the corridor, the Concept 4 (East) alternative incorporated a shared use path on the north/west side of the corridor between East Avenue and Barrett Street. The corresponding south/east side of the corridor were assumed to have a raised, separated bike lane adjacent to the sidewalk like in Concept 2. The justification for locating the shared use path on the north/west side of the corridor through this segment was to accommodate the slower moving, uphill cyclists on the shared use path and the faster, downhill bicyclists in a dedicated bike facility. The slower moving cyclists climbing the steepest section of Colchester Avenue would mix well with pedestrians, especially from a pedestrian safety standpoint when compared to the considerably faster speeds of a downhill bicyclist. However, the shared use path would be on the opposite side of Colchester Avenue from the existing side path on the western end, requiring users to cross two legs of the East Avenue intersection in order to stay on a shared use path facility along the entire length of the corridor.

A graphic depicting the typical corridor cross-section and the plan view of Concept 4 in two segments are included in **Figure 16**.

**Figure 16: Colchester Ave Corridor Concept 4 (East): Shared Use Path**





4.2.7 Corridor Concepts East of East Avenue – Evaluation Matrix

An evaluation matrix of the alternatives presented in Section 4.2 is shown in **Table 3** below. This matrix compares the relative costs, safety, resource impacts, and community character implications for each alternative.

Table 3: Colchester Avenue Corridor Concepts East of East Avenue – Evaluation Matrix

		Colchester Avenue Corridor Concepts (East)				
		Concept 1 (East) On-Street Separated Bike Lanes	Concept 2 (East) Raised and Separated Bike Lanes	Concept 3 (East) Raised and Separated Bike Lanes with Enhancements	Concept 3A (East) Raised and Separated Bike Lanes with Enhancements and Mixing Zone	Concept 4 (East) Shared Use Path and Separated Bike Lanes
Costs	Total Cost	\$\$	\$\$\$	\$\$\$	\$\$\$	\$\$\$
Impacts	Bicycle Safety	Improved <i>Cyclists in separated facility</i>	Improved <i>Cyclists in separated facility</i>	Improved <i>Cyclists in separated facility</i>	Improved <i>Cyclists in separated facility or shared use path</i>	Improved <i>Cyclists in separated facility or shared use path</i>
	Pedestrian Safety	No Change / Slightly Improved <i>Fewer cyclists using sidewalk</i>	No Change / Slightly Improved <i>Fewer cyclists using sidewalk</i>	No Change / Slightly Improved <i>Fewer cyclists using sidewalk</i>	No Change/Slightly Worse <i>Pedestrians in separated facility except for mixing zone area</i>	No Change/Slightly Worse <i>Cyclists and Pedestrians in shared path on North side at east end of project.</i>
	Vehicle Safety	Slightly Improved <i>Reduce conflicts with cyclists by defining and separating spaces</i>	Slightly Improved <i>Reduce conflicts with cyclists by defining and separating spaces</i>	Slightly Improved <i>Reduce conflicts with cyclists by defining and separating spaces</i>	Slightly Improved <i>Reduce conflicts with cyclists by defining and separating spaces</i>	Slightly Improved <i>Reduce conflicts with cyclists by defining and separating spaces</i>
Impacts	Utility Impacts	Major Impacts	Major Impacts	Major Impacts	Major Impacts	Major Impacts
	ROW Impacts	No Impacts	No Impacts	Minor Impacts	Minor Impacts	No Impacts
	Constructability	Major Effort	Major Effort	Major Effort	Major Effort	Major Effort
	Parking	Elimination of On-Street Parking (Colchester Ave)	Elimination of On-Street Parking (Colchester Ave)	Maintains Some On-Street Parking (Colchester Ave)	Maintains Some On-Street Parking (Colchester Ave)	Elimination of On-Street Parking (Colchester Ave)
	Trees	Moderate Impacts to Existing; Some Tree Belt Opportunity	Moderate Impacts to Existing; Some Tree Belt Opportunity	Major Impacts to Existing; Increased Tree Belt Opportunity	Major Impacts to Existing; Increased Tree Belt Opportunity	Moderate Impacts to Existing; Some Tree Belt Opportunity
	Historic	No Impacts	No Impacts	No Impacts	No Impacts	No Impacts
	Archaeological	No Impacts	No Impacts	No Impacts	No Impacts	No Impacts
Community Character	Aesthetics	No Change	Improved	Improved	Improved	Improved
	Satisfies Purpose & Need	No*	No*	Yes	Yes	No*

\* unmet on-street parking need requiring alternative locations to accommodate parking



### 4.3 Intersection Alternatives – Colchester Avenue & East Avenue

The third focus area for evaluation was the intersection of Colchester Avenue and East Avenue, shown in **Figure 17**. Alternatives evaluated for the intersection included: new signal equipment and striping upgrades at existing intersection, new signal equipment and striping upgrades with realignment of the intersection and a new bike signal, new signal equipment and striping upgrades with realignment of the intersection, and a roundabout.

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Figure 17: Intersection of Colchester Avenue & East Avenue





#### 4.3.1 No Build Intersection Alternative

The no build alternative at this intersection would facilitate the preferred alternatives for the west and east corridor, which may involve the shifting of curbs and updated striping on either Colchester Avenue approach to the intersection. Beyond that, the no build alternative would maintain operation consistent with the current condition.

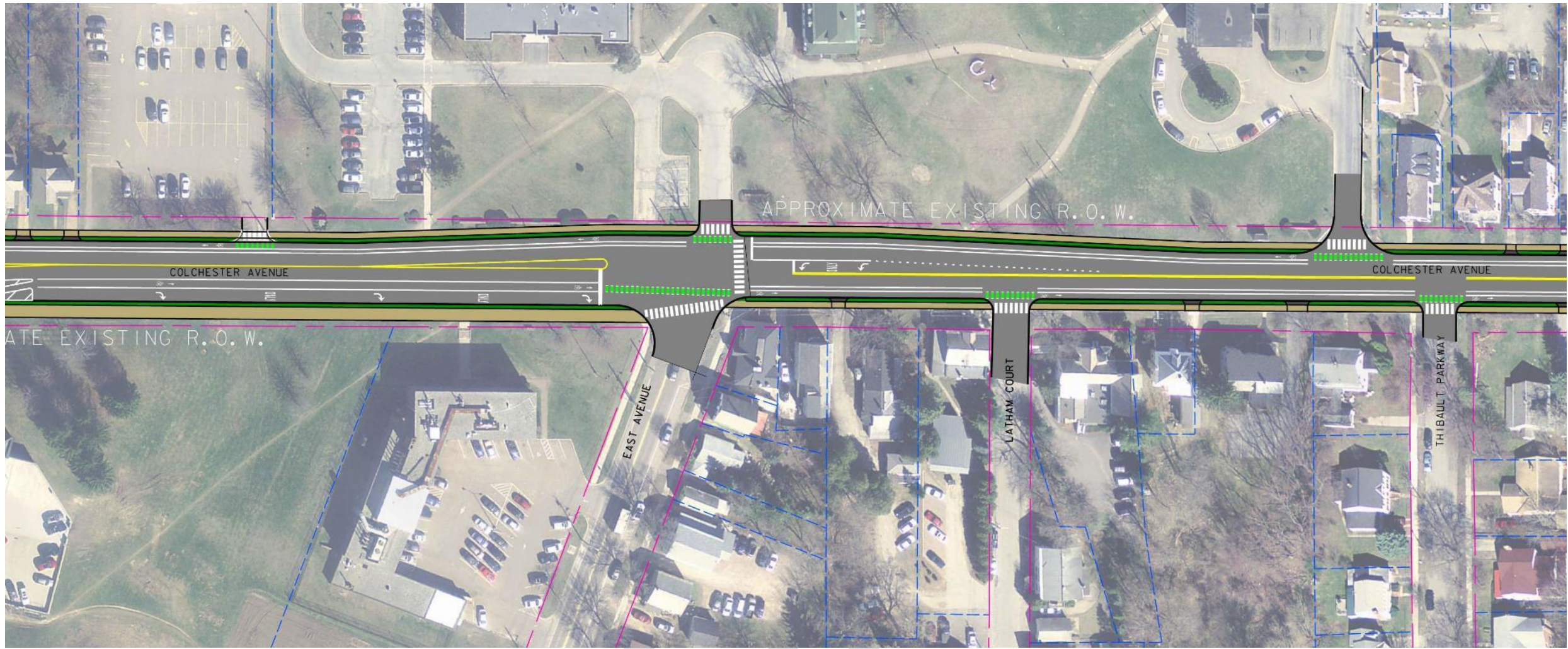
#### 4.3.2 Intersection Alternative 1 – Equipment and Striping Upgrades at Existing Signalized Intersection

The first build alternative would not shift the curblines, but rather address many of the other first tier safety recommendations from the HSIP location review, including installation of new signal equipment mounted on new mast arms and mast arm poles with improved alignment with the lane each signal face serves. The signal head upgrades would include backplates, per the HSIP recommendations. Signal timing at the intersection may be adjusted to improve pedestrian accommodation by providing a leading pedestrian crossing phase. This means that although the pedestrians would cross the intersection concurrently with vehicle traffic, the pedestrians would get a head start in their crossing movement to make them more visible to traffic once vehicles are permitted to move. This would result in a LOS E for the future 2040 traffic condition. Otherwise the intersection will largely remain the same as the No Build in this alternative.

A graphic depicting Alternative 1 is included in **Figure 18**.



Figure 18: Colchester Ave & East Ave Intersection Alternative 1: Equipment and Striping



### 4.3.3 Intersection Alternative 2 – Equipment and Striping Upgrades with Realignment of Intersection and New Bike Signal

The second build option for the intersection of Colchester Avenue and East Avenue would take advantage of the signal upgrades outlined in Alternative 1, but will also implement the second tier recommendations from the HSIP location review to realign the intersection. The realignment will shift the East Avenue and Trinity Campus approaches to the intersection, squaring the former to be closer to a 90-degree connection to Colchester Avenue and shifting the latter to directly align with the new East Avenue approach. The realignment will allow for an extension of the dedicated right turn lane to accommodate the traffic approaching from the south more appropriately. In addition, the realignment of the offset and skewed approaches will permit concurrent phasing for the minor legs of the intersection.

In addition to the realignment and updated signal phasing at this location, a new bike signal is proposed to facilitate the eastbound through bike movement with its own phase. Having new signal equipment and a new cabinet allows for the installation of a bike signal with a dedicated phase of the cycle. Furthermore, the bike signal would allow for cyclists to remain to the right of the vehicular right turn lane when approaching the intersection, affording significantly more protection to the bicyclists than in the current condition. Although not shown, crossing on the west leg of the intersection was discussed as an option with this alternative and evaluated in the traffic analysis. The concurrent phasing coupled with the bike signal phase and exclusive pedestrian phase would result in a LOS C for the future 2040 traffic condition.

A graphic depicting the Alternative 2 intersection is included in **Figure 19**.

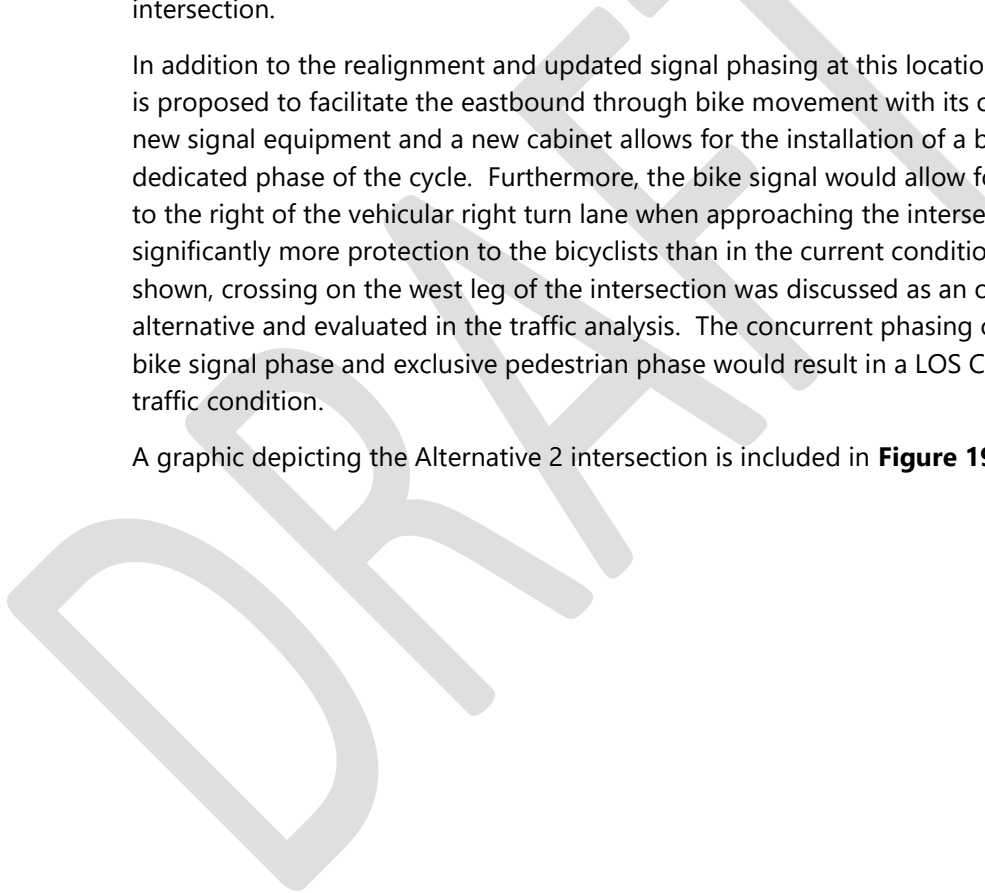
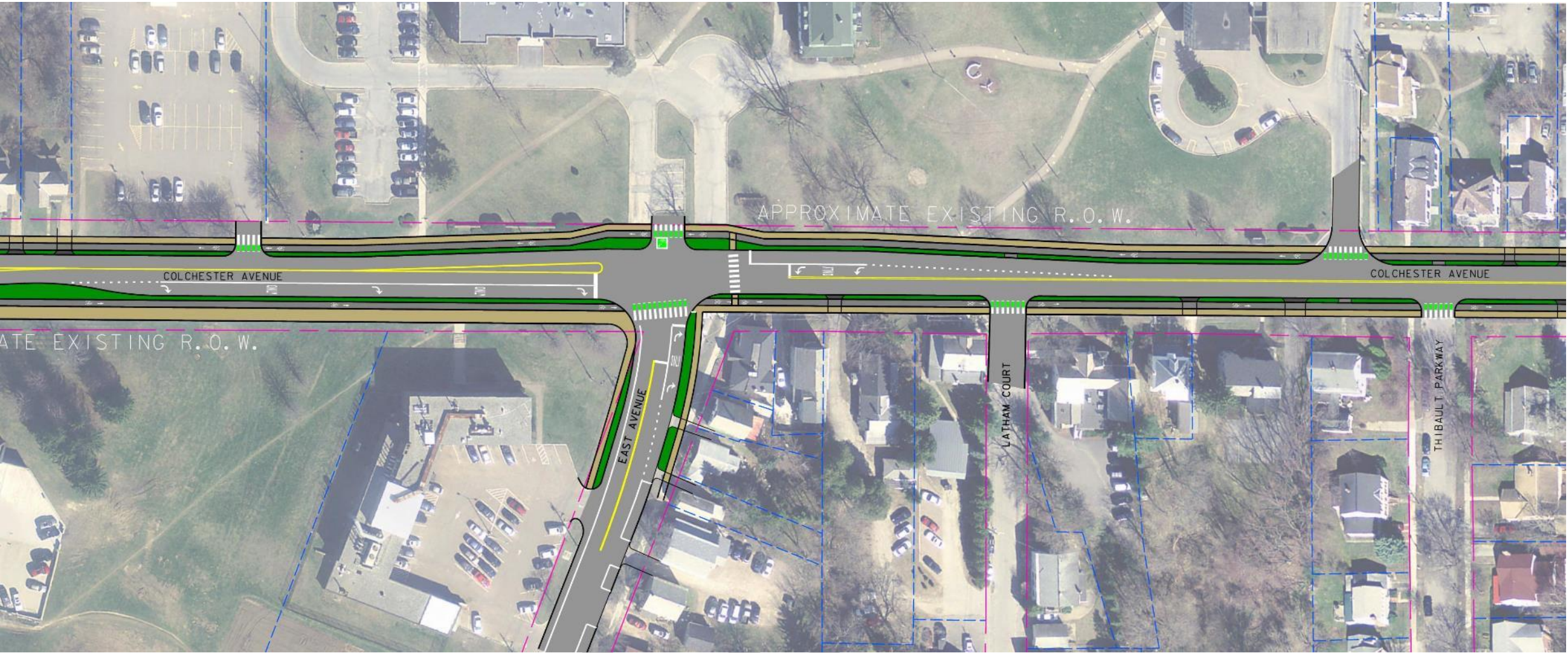




Figure 19: Colchester Ave & East Ave Intersection Alternative 2: Equipment and Striping Upgrades with Realignment of Intersection & New Bike Signal





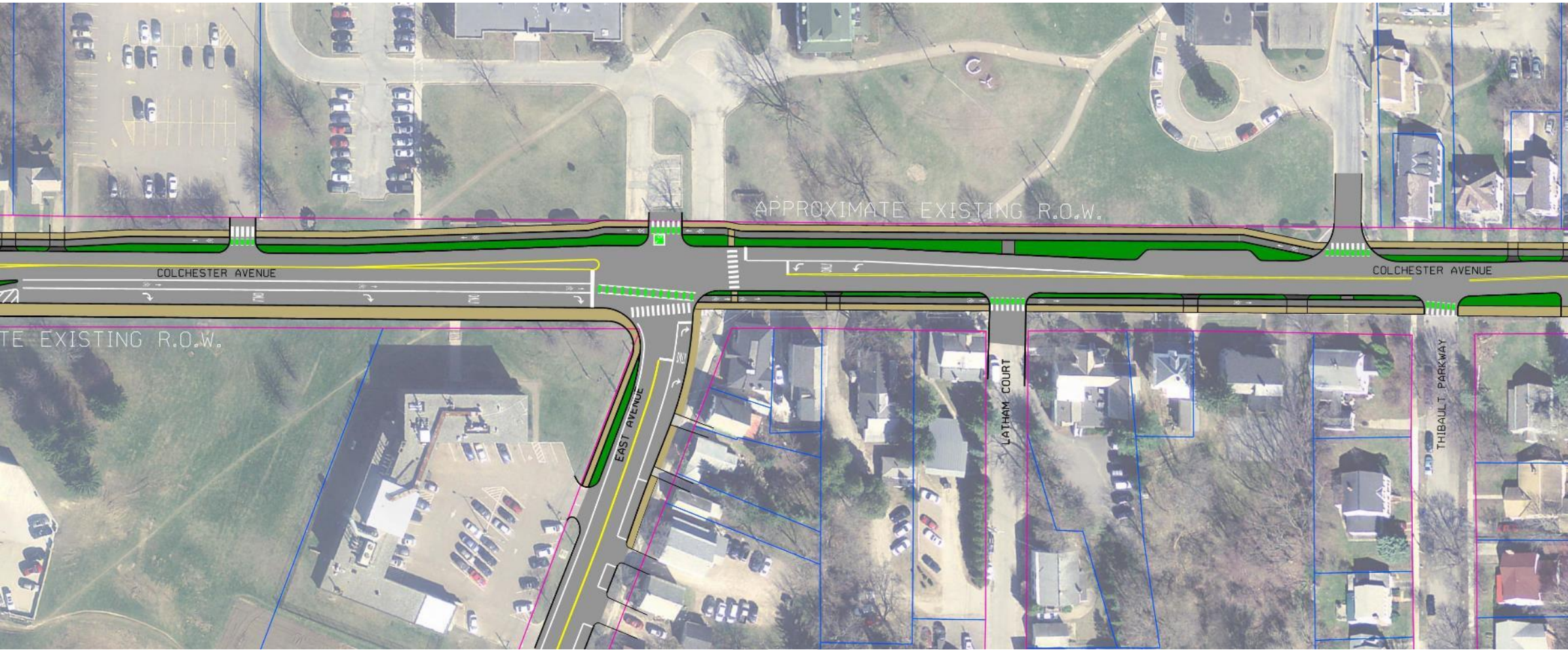
#### 4.3.4 Intersection Alternative 3 – Equipment and Striping Upgrades with Realignment of Intersection

The third build alternative at the intersection would borrow the signal upgrades outlined for Alternative 1 and the realignment outlined for Alternative 2. In addition to these upgrades addressing the recommendations from the HSIP, this approach would bring cyclists up to the intersection on the eastbound approach with dedicated bike lane between the through and right turn vehicular lanes. The cyclists would then be served by the through movement vehicle signal at the intersection. The shifting of curbs would afford the additional width necessary to accommodate this facility. In addition, a pedestrian crossing on the west leg of the intersection was discussed as a possibility with this alternative and evaluated in the traffic analysis. The realignment would allow for concurrent signal phasing to serve the two minor legs, providing an anticipated overall LOS C in the 2040 future traffic condition.

A graphic depicting the Alternative 3 intersection is included in **Figure 20**.

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Figure 20: Colchester Ave & East Ave Intersection Alternative 3: Equipment and Striping Upgrades with Realignment of Intersection





#### 4.3.5 Intersection Alternative 4 – Roundabout

The fourth build alternative for this intersection is a modern, 120-foot inscribed diameter, single lane roundabout. A roundabout at this location would serve to realign the legs of the intersection converging at the center of the new facility. A mini-roundabout was not considered at this location based on the volumes along Colchester Avenue (approximately 15,000 vehicle per day) and high percentage of left hand turns at the intersection.

Each approach would have a pedestrian crossing, rounding out the pedestrian access at the intersection by providing crossings on all four legs. The pedestrian crossings on the Colchester Avenue and East avenue approaches would include protected pedestrian refuge mid-crossing with a curbed splitter island, allowing for pedestrians to cross a single lane with one direction of traffic at a time. Bike crossings at each approach are similarly proposed.

With yield conditions on each approach and appropriate deflection, the roundabout would likely work to slow traffic through the intersection, but maintain steady flow of traffic without the queueing from cycle loss time that is experienced in the current signalized condition. Overall, the roundabout is anticipated to operate at a LOS C in the future 2040 traffic condition.

A graphic depicting the Alternative 4 intersection is included in **Figure 21**.

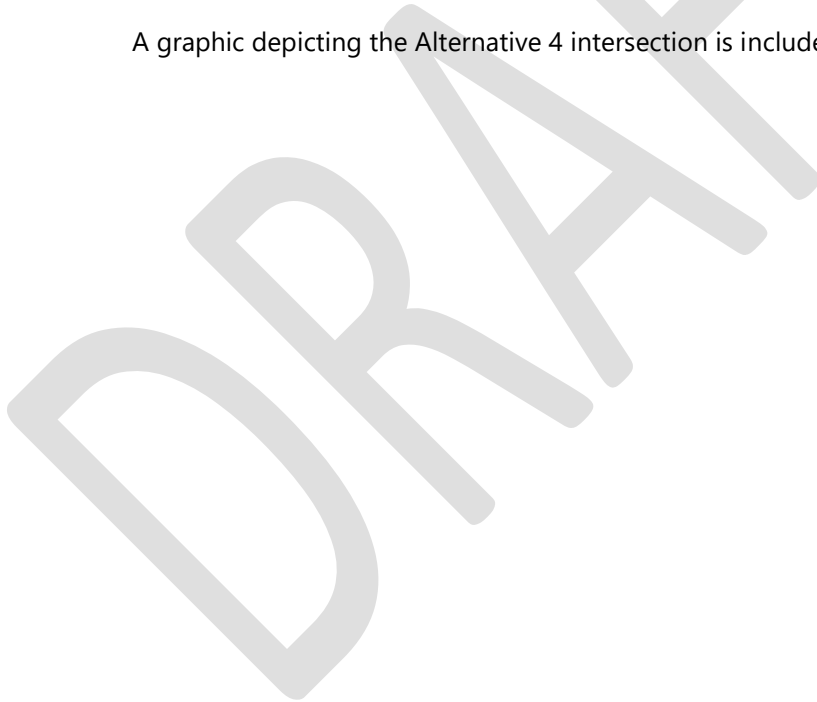
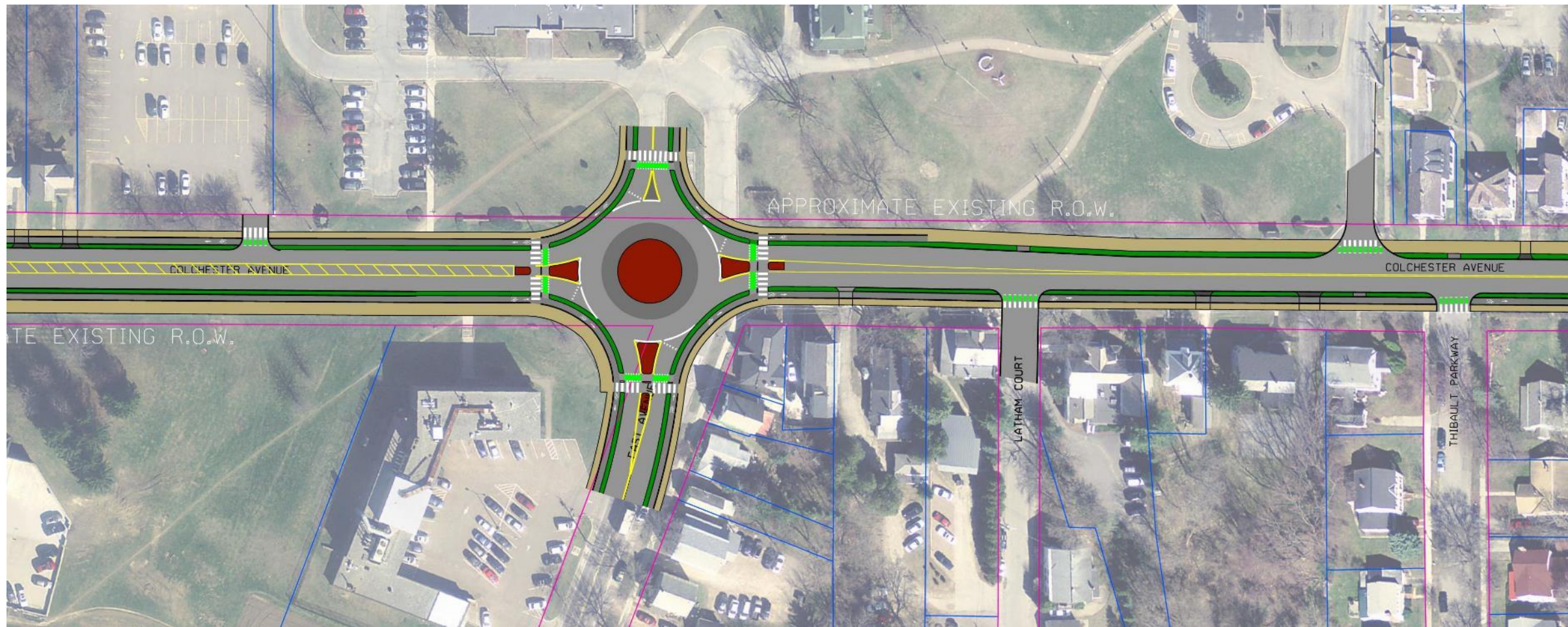


Figure 21: Colchester Ave & East Ave Intersection Alternative 4: Roundabout





4.3.6 Intersection Evaluation Matrix

An evaluation matrix of the alternatives presented in Section 4.3 above is shown in the table below. This matrix compares the relative costs, safety, resource impacts, and community character implications for each alternative.

Table 4: Colchester Avenue & East Avenue Intersection Alternatives Evaluation Matrix

		Colchester Avenue / East Avenue Intersection Alternatives					
		Concept 0 No Build	Alternative 0 No Build	Alternative 1 Equipment and Striping Upgrade	Alternative 2 Equipment and Striping Upgrades with Realignment of Intersection & New Bike Signal	Alternative 3 Bike Lane Through Intersection	Alternative 4 Roundabout
Costs	Total Cost	\$0	\$0	\$350,000	\$980,000	\$950,000	\$3,500,000
Safety	Benefit Cost Analysis (B/C ratio)			3.03	1.12	1.16	0.40
	Bicycle Safety	-	-	Slightly Improved <i>Bike Lanes provided westbound through signal</i>	Improved <i>Bikes provided protected lane and phase - no turn conflicts</i>	Slightly Improved <i>Cyclists have to travel between thru and right turn lanes, but protected</i>	Slightly Improved <i>Bikes only conflict with single movement at time, but not fully protected; fewer conflict points</i>
	Pedestrian Safety	-	-	Improved <i>Protected Crossings with less delay with vehicular phasing</i>	Improved <i>Protected Crossings with less delay with vehicular phasing</i>	Improved <i>Protected Crossings with less delay with vehicular phasing</i>	Slightly Improved <i>Allow additional cross locations, but unsignalized; shorter crossings with lower speed vehicles; fewer conflict points</i>
	Vehicle Safety	-	-	Slightly Improved <i>by separating users, proper equipment</i>	Improved <i>by fully separating users, proper equipment</i>	Slightly Improved <i>by separating users, proper equipment</i>	Significantly Improved <i>Lower vehicle speeds and fewer conflict points</i>
Operations	Overall Level of Service (2040)	-	-	LOS D	LOS C	LOS C	LOS C
	Utility Impacts	-	-	Major Impacts	Major Impacts	Major Impacts	Major Impacts
	ROW Impacts	-	-	Minor Impacts	Minor Impacts	Minor Impacts	Moderate Impacts
	Constructability	-	-	Minor Effort	Major Effort	Major Effort	Major Effort
Impacts	Parking	-	-	Existing Parking Maintained (East Ave)	Slight Reduction (East Ave)	Slight Reduction (East Ave)	Slight Reduction (East Ave)
	Trees			No Impacts	Minor Impacts To Existing	Minor Impacts to Existing	Minor Impacts to Existing
	Historic	-	-	No Impacts	No Impacts	No Impacts	No Impacts
	Archaeological	-	-	No Impacts	Additional Review Recommended	Additional Review Recommended	Additional Review Recommended
Community Character	Aesthetics	No Change	No Change	No Change	Improved	No Change	Significantly Improved
	Satisfies Purpose & Need	No	No	Yes	Yes	Yes	Yes



# 5

## **Preferred Corridor Concept & Intersection Alternative Plan**

Based on findings from technical analyses and input from the public and project Advisory Committee, conceptual plans were developed to reflect the preferred corridor concepts and intersection alternative. This consisted of a combination of Corridor Concept 2 (West) with raised and separated bike lanes; a modified Corridor Concept 3A (East) with raised and separated bike lanes with targeted on-street short-term parking and pull-outs for transit stops, delivery vehicles, or other short-term uses; and Intersection Alternative 2 with new equipment, striping, a crossing on the western leg of the intersection, and a dedicated bike signal for the intersection with East Avenue.



## 5.1 Overview

The preferred corridor concepts and intersection alternative selected through the public process and stakeholder decision making include:

- › a consistent cross section for the length of Colchester Avenue that provides raised, separated bike facilities in addition to updated, curbed travel lanes and sidewalk improvements;
- › enhancements between East Avenue and Greenmount Cemetery to provide targeted, short-term, high turnover parking in support of businesses and pull-outs for transit stops, loading or delivery, and other short-term uses; and,
- › improvements to the intersection with East Avenue that provides new signal equipment with a dedicated bike signal and updated lane geometries with realignment of East Avenue and the UVM Trinity Campus entrance.

This chapter enumerates the design features of these improvements and recommendations for the corridor.

### 5.1.1 Colchester Avenue Preferred Corridor Concepts

For the segments of the Colchester Avenue west and east of the intersection with East Avenue, the preferred corridor concepts and intersection alternatives will provide a consistent cross section that includes raised and separated bike lanes in both directions. Through most of the corridor, the bike lanes will be separated from vehicular travel lanes by curb and a planting strip or greenbelt. Greenbelt separation is advantageous in recovering the grade differential between the road and bike lane, providing adequate snow storage, and accommodating signage, lighting, and other curbside features. Where width is available, this planting strip will be greater than 5' in width to accommodate street tree plantings, bus shelters, utilities, lighting, and other curbside amenities where appropriate. Along approximately 60% of the corridor, where the bike lane is separated from vehicular traffic by less than 5' of greenbelt, primarily to limit impact beyond the back of sidewalk, the width will not support tree plantings but will still benefit from other curbside features.

The raised bike lanes will be adjacent to existing or relocated sidewalks through much of the corridor. Where the pedestrian facilities are adjacent to the updated bike lanes, the two facilities will be delineated by a beveled curb and different surface treatments, making clear distinctions of where pedestrians and bicyclists are expected to walk and bike. It is noted that where sidewalks are not relocated, and therefore not necessarily rebuilt, assessment of the existing sidewalk should be conducted and sidewalks not meeting current standards or in disrepair should be reconstructed through much of the corridor.

The preferred corridor concept on the east end of the corridor, particularly between East Avenue and Greenmount Cemetery, incorporated some modifications to enhancements presented in the corridor concepts along this segment. Those enhancements include 2-3 high turnover, on-street parking spaces in front of Kampus Kitchen and strategically located curbside pull-outs to accommodate either transit bus stops or short-term uses like delivery vehicles or short-term, high turnover parking.

At the Draft Alternatives Presentation, the public weighed in on the various corridor concepts with clear support for Concept 2 (West) and the desire for a consistent treatment on the segment east of East Avenue, narrowing the choices to Concept 2, 3, or 3A. Hearing this, the Advisory Committee similarly supported the raised, separated bike lanes in Concept 2 (West) and, through much deliberation, generally supported Concept 3A (East) with modifications, falling just one vote shy of consensus. Through the discussion, it was clear that the Advisory Committee and the entities that they represent support consistent bike infrastructure separated from vehicular traffic, improved curbside access for transit, support of local businesses through provision of some high turnover parking spots, and support of other short-term, curbside neighborhood activities like deliveries.

The figures below depict the improvements for the corridor along the length from west () to east ().

### 5.1.2 Colchester Avenue and East Avenue Preferred Intersection Alternative

The Colchester Avenue and East Avenue preferred intersection alternative will include major upgrades to the signal equipment at the existing intersection, realignment of the minor legs of the intersection, and an additional pedestrian crossing on the west leg of the intersection.

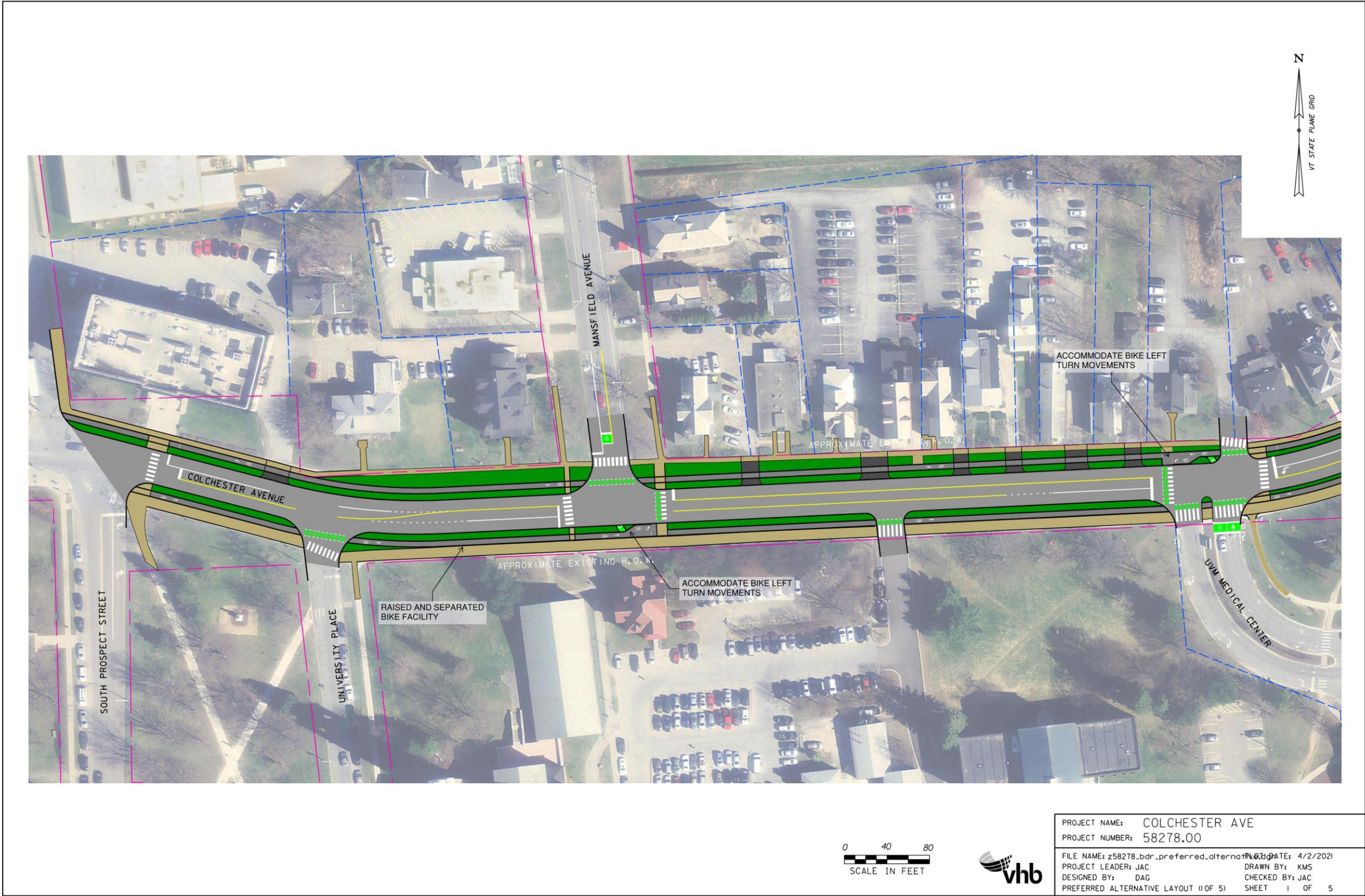
The intersection realignment will consist of shifting the UVM Trinity Campus driveway to the west approximately 35' to bring it into alignment with the new horizontal alignment of the East Avenue intersection leg. The East Avenue approach to the intersection will be reconstructed to intersect Colchester Avenue at close to perpendicular, effectively shifting the intersection leg west by approximately 20' feet. This will entail full depth construction of new roadway areas, particularly on the southwest corner of the intersection, and reclamation of the areas decommissioned, particularly on the southeast corner of the intersection.

The signal upgrades will entail removal of existing mast arm poles, mast arms, pedestals, signal heads, and signal cabinet. This equipment will be replaced with new mast arm poles, mast arm mounted signal heads with backplates, and signal cabinet. In addition to the updated signal equipment a dedicated bike signal face will be installed for the eastbound cyclists. The dedicated bike signal allows for the bike infrastructure to remain outside of the vehicular right turn lane and serves the through movement cyclist once they approach the intersection.

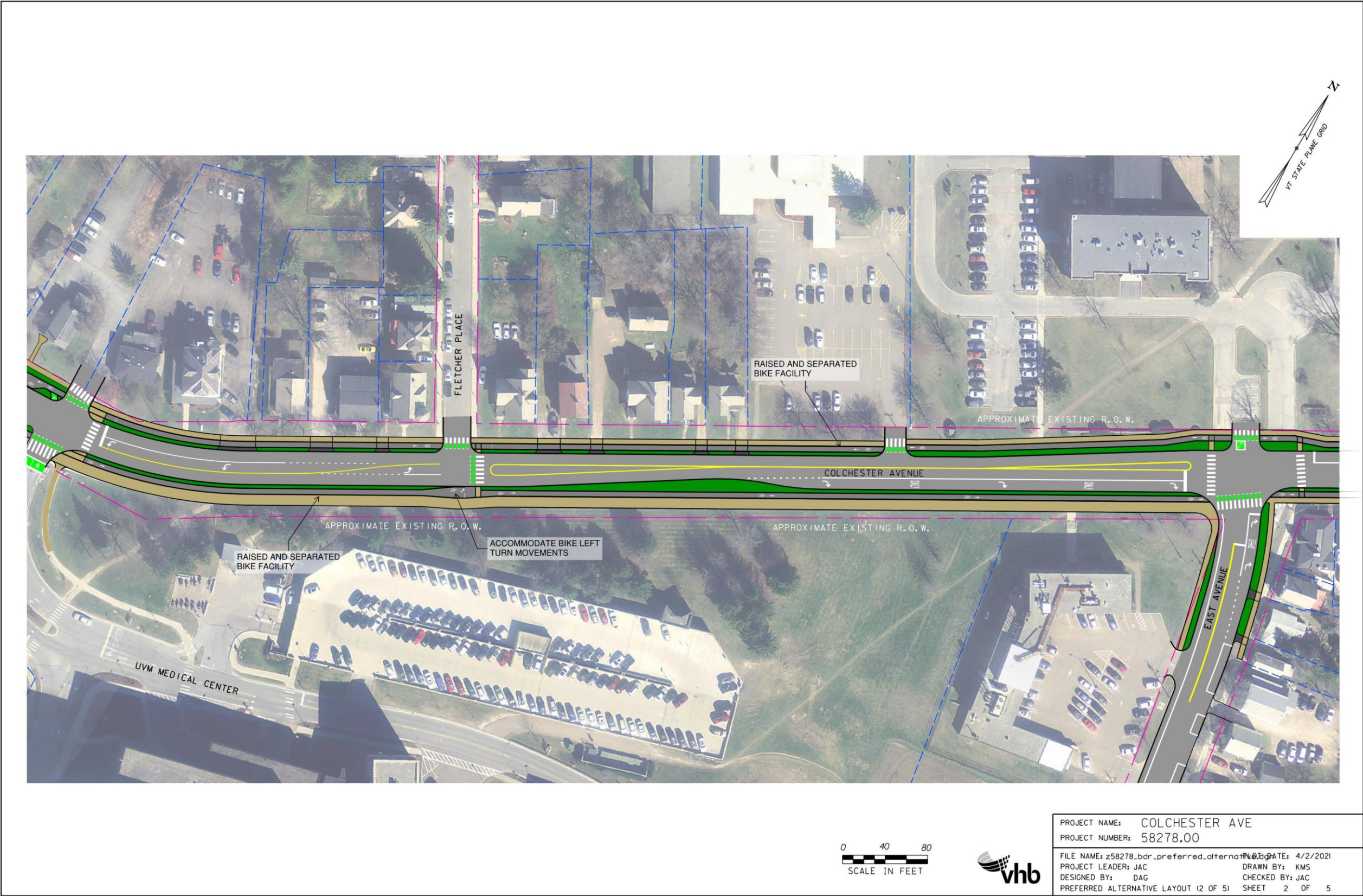
The realignment will allow for updated timing and phasing. Aligning the East Avenue leg and the UVM Trinity Campus driveway will allow for concurrent phasing, providing a portion of the cycle for dedicated bike and pedestrian phases. The crossing on the western leg of the intersection will be added. The heavy conflicting northbound left and eastbound right movements at the intersection make concurrent pedestrian phasing challenging, and therefore an exclusive pedestrian phase to serve all of the crosswalks should be considered.

The figure below, , depicts the preferred improvements being proposed for the Colchester Avenue and East Avenue intersection.

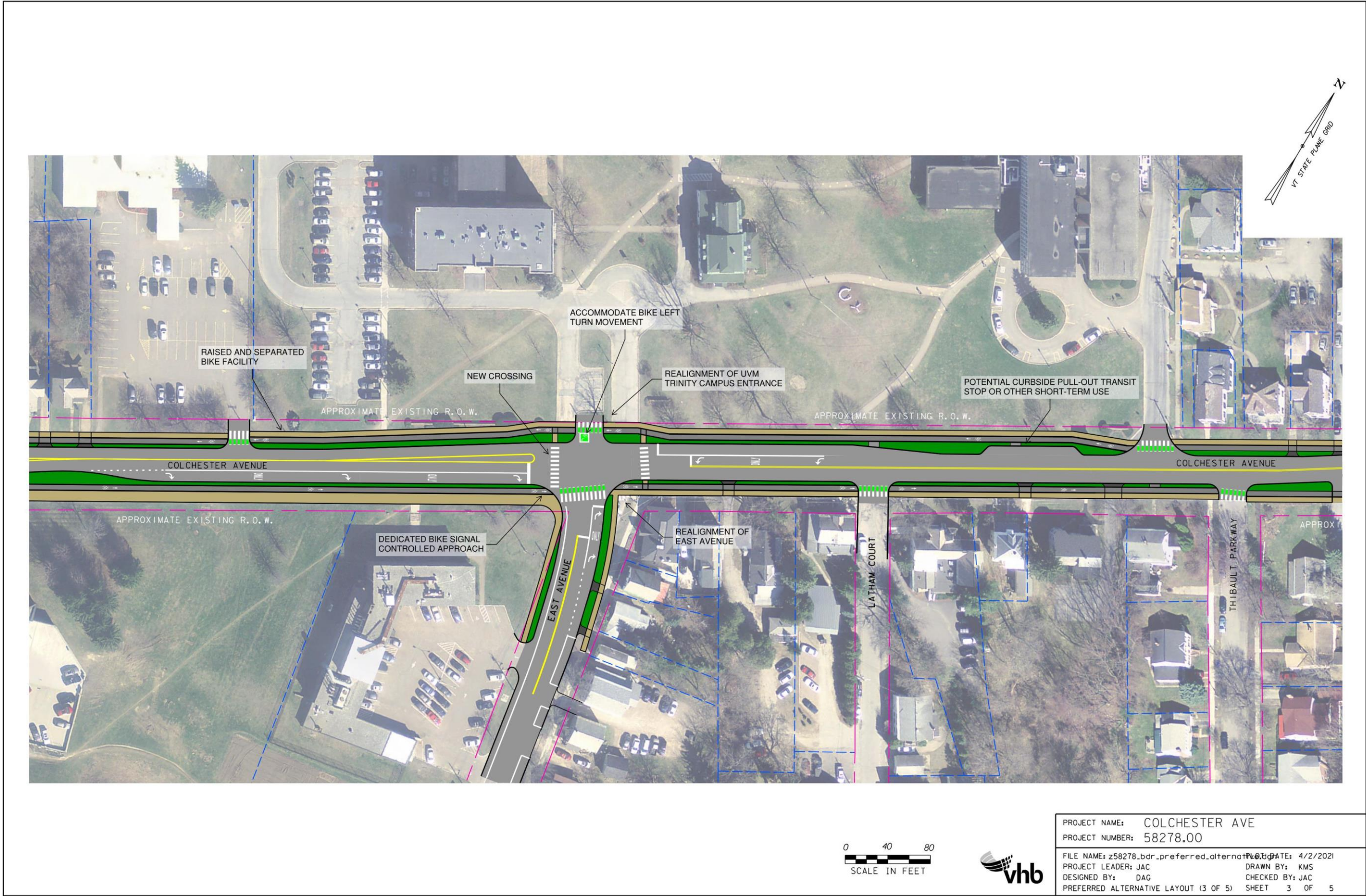






















### 5.1.3 Recommendations and Other Considerations

As indicated in the preferred corridor concepts and intersection alternatives for Colchester Avenue, changes to the existing curb line are a significant undertaking, but also provide an opportunity to adopt and implement the desired character of the corridor. Not only does Colchester Avenue provide critical access from a transportation standpoint, but it also serves as a corridor for many utilities. Careful coordination in planning and design with utility providers on any necessary relocation and new utilities will be necessary. This also presents an opportunity to consider pedestrian scale lighting as well as transit shelters and street furniture as appropriate.

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